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Working Paper 275

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ERGONOMIC STANDARDS FOR DISABLED PEOPLE IN PEDESTRIAN AREAS

Results from Leeds Observation Work 1988/89

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This work was sponsored by TRRL.

ABSTRACT

This working paper is one of a series (WP 252, 253, 254, 255, 274, 275), describing work undertaken under contract to TRRL investigating design guidance for pedestrian areas and footways to satisfy the needs of disabled and elderly people. This working paper reports on fieldwork conducted with disabled people in Leeds to investigate movement distances; assessments of surface conditions including gaps, undulation, gradients, camber and friction; and assessments of bus shelter seating.

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1. INTRODUCTION

1.1 Study Objectives

1.1.1 In May 1986, the Institute for Transport Studies at the University of Leeds was awarded a contract by the Transport and Road Research Laboratory for the Development of Ergonomic Standards for Pedestrian Areas for Disabled People. The project was timetabled to take 22 months from 1st July 1986 to 30th April 1988. It was later extended into a second stage to be completed by May 1989. A separate element of the study was to provide assistance to the Institution of Highways and Transportation in the revision of their guidelines "Providing for People with a Mobility Handicap".

1.1.2 The objectives of the study laid down in the design brief by the Transport and Road Research Laboratory were:

(a) To produce a guide to good practice for the design and maintenance of footways and pedestrianised areas;
(b) To provide, where possible, recommended standards for design and maintenance.

The good practice guide and the recommended standards were to be primarily aimed at disabled people and the elderly, but the requirements of the able-bodied were also to be considered, as were conflicts between the needs of different groups of user. The economic implications of implementation and maintenance were also to be detailed.

1.1.3 The study benefited throughout from the guidance given by an Advisory Committee, which included representatives of disabled people's organisations and local authorities, as well as of DTp and DoE.

1.2 Study Structure

1.2.1 Stage One of the study was divided into the following elements:

(a) a review of the literature and discussions with organisations involved with disabled people to identify priority issues for study;
(b) a short initial interview survey aimed at a 10% sample of registered disabled people in Leeds to select samples for more detailed interview and observation;

(c) more detailed interviews in Leeds with a sample of around 50 from each of five selected types of disability, to obtain information on physical and perceived pedestrianised areas access;

1.2.2 Stage Two involved the study of access-related problems in centres smaller than Leeds, and a more detailed study of impediments and of the design of seats; it comprised the following elements:-

(a) detailed interviews with a sample of around 50 from each of five types of disability in York;
(b) similar interviews, but with smaller samples, in Beverley;
(c) brief interviews for similar samples in Leeds;
(d) observation surveys of impediments and seats for the Leeds samples;
(e) physical measurement of the impediments and seats observed in Leeds.

This Working Paper covers items (a) and (b).

1.2.3 This Working Paper is one of a set of Working Papers 252, 253, 254, 255, 274 and 275 describing work investigating design guidance for pedestrian areas and footways to satisfy the needs of disabled and elderly people.

1.2.4 A slightly different approach was adopted in categorising ambulatory disabled groups in Stage 2 than was used in Stage 1. In Stage 2 respondents were simply categorised by whether an aid was used, and in York whether the aid was one stick or two sticks, this latter category including Zimmer frames and so on.

1.3 Study Method

1.3.1 Respondents were contacted initially by a letter from the Director of Social Services of Leeds City Council which invited potential participants to return a slip to the Institute. The letter was sent to the sample of people on the handicapped register, blind register and partially-sighted register, who had been contacted in earlier stages of the research. Respondents were then contacted by phone to arrange a mutually convenient date. A further 73 participants were contacted directly at day centres; this allowed the selection of participants with disabilities that were under-represented in the mail response.

1.3.2 Up to eight participants at a time were brought from their homes, or from day centres, to the city centre in a minibus adapted to carry disabled passengers. A small number of participants chose to travel to the city centre in their own cars or by other means. Participants were encouraged to travel with a friend or helper, if they wished, although few did so.

1.3.3 An interview form was devised on which both answers to a number of questions put to participants were written and data from a movement distance exercise were recorded (Appendix E). The interview questions aimed to investigate first, basic details of age, sex and type of aids used; and then to investigate how frequently participants went out of their homes, need for assistance when going outside. This information was recorded to contribute to the project's aim of investigating access problems and for later comparison with performance in the movement distance exercise and attitudes towards impediments in the city centre.

1.3.4 The movement distance exercise was developed from an appreciation of methodological problems encountered in the first stage of the project in which participants had sometimes travelled in groups, affecting timings and the incidence of pauses. For this stage of the project two methods of conducting the movement distance exercise were piloted. In the first, participants moved around the block from the junction of Albion Street and Albion Place, to Commercial Street, Lands Lane (not shown), and returning along Albion Place (see Appendix C for map). Interviewers were placed at strategic points to record the progress of participants. This method was not adopted because of the difficulty interviewers found in recording all the necessary information when two or more participants were in their area.

1.3.5 In the second piloted method, which was adopted for the main exercise, survey participants were asked to travel around an essentially level circular route of 180 m while they were being timed. Participants were advised that although they would be timed they were not to attemp to travel as fast as they could, but to proceed at their ordinary pace, and to take rests whenever they wished. At the end of the route, participants were asked how the distance they had just travelled compared to normal trips to the city centre, and whether they would be willing to travel around the route a second time. If they were willing, they then travelled round the course again, and at the end were asked again how the distance compared to normal visits. Participants normally moved singly, without assistance, to avoid the possible effect of a group adjusting its pace to the slowest, or individuals attempting to compete with other participants. A St John Ambulance officer was in attendance at all times. Interviewers stayed at some distance from the participant so as not to affect the pace of progress while being able to make timings. Where a participant requested assistance or guidance for visually handicapped participants, it was provided in the first instance by the interviewer, or by the St John Ambulance attendant.

1.3.6 Participants in the movement distance exercise were asked to comment on the route or their feelings of fatigue as they moved around it. Interviewers were instructed to be careful not to lead participants to make any particular type of comment, so that matters raised would be those which participants thought relevant. For this purpose participants were fitted with small tape recorders and microphones.

1.3.7 Participants then took part in the surface conditions exercise. A problem that had been found in Stage 1 of the project had been that participants were expected to rate on a semantic differential scale the difficulty associated with a number of variables for each of the locations they were taken to. This was thought to be over-tedious for the participants so that individual questions were answered with insufficient discrimination. It was thought preferable in this stage of the project to simplify the questionnaire so that an overall assessment of each site was given, and then the individual variables that caused participants difficulty could be picked out.

1.3.8 A further problem that had been identified in Stage 1 was that the sites were usually fairly large and included a variety of materials, standards of maintenance, and gradients, making it difficult for the participant to give meaningful responses to questions. This was overcome in this stage of the research by adopting smaller sites that could more easily be assessed.

1.3.9 In the surface condition exercise each participant was taken in turn to nine rectangular sites 2 metres x 5 metres that had been marked out in Albion Street. The sites were marked out so that examples of different qualities of maintenance standards and materials would be shown to the participants. Each of the sites was positioned so that the long side was orientated in the direction of flow in that area.

1.3.10 The participants were asked to move along the marked areas, or to otherwise assess it. After they had inspected each site, participants were asked a number of questions. They were asked "In general, how difficult do you find moving over the marked area?", and "In genral how much of a risk of stumbling/disrupting your progress do you think that the marked area could represent to you?". Participants were asked to choose from a range of possible answers: for the former question: impossible/very difficult/difficult/some difficulty/no difficulty, and for the latter question: a severe risk/a slight risk/no significant risk. If "no difficulty" and "no significant risk" were not selected, a further question was asked to determine the cause or causes of difficulty. Participants were asked "What is it about the marked area that causes you difficulty? Do you think it is gaps in between the paves, the slope of the pavement, camber, general uneveness, slipperiness, or something else?" Each of the causes of difficulty at each site that the participant mentioned was noted.

1.3.11 Each site was measured at a later date for a number of characteristics. The length of gaps of >5 mm, 10-20 mm, 20-30mm and >30 mm width was measured when the depth of gap was >5mm. A grid with 0.5 m nodes was laid out over the 2 m x 5 m rectangle and the difference in height between the level of the pavement and an horizontal plane measured. The data were used to generate a 'best fit' plane, and the difference between the hypothetical best fit plane and the pavement measurements was used to describe the extent of undulation in the rectangle. This method is described more fully in Working Paper 255. Based on the data obtained for undulation, the camber of each site was calculated. The surface friction of each site was measured using a portable skid resistance tester, as described in TRRL Road Note 27.

1.3.12 In the final part of the field work, participants were shown, and invited to try out, four types of bus shelter seat: a narrow 'perch' type of seat; a 'fliptop' type of seat; a wire mesh type of seat, and a park bench. The types of seat tested are all in use in West Yorkshire, and were set at typical heights that have been found in practice. Details of the seats and their dimensions are to be found in Appendix D.

1.3.13 Participants were taken to each of the seating units and asked to try out the seats. For each seat in turn, participants were asked: "Have you seen this type of seat before?", "If you were waiting for a bus which was not expected for the next five minutes, or so, would you use this type of seat if it were available?". Participants were then read out a number of statements about the seats and were asked to indicate whether they agreed with the statements. The statements related the comfort with which the participant could sit at the height of the seat; the usefulness of an arm-rest; the security of the participant while sitting on the seat; the use of the back-rest; and the texture of the surface. Each statement was paired with an opposing statement, eg "This seat would be comfortable for me to sit on" was paired with "This seat would be uncomfortable for me to sit on", and participants were free to agree with either, neither or both of the statementss. Participants were also asked for any comments about any other features of the seats.

2. INTERVIEW RESULTS

2.1 Information about Participants

2.1.1 A total of 224 disabled people living in the Leeds area were brought to the city centre for observation work. They were categorised initially by the aids used; and those categories were combined to make four principal disability groups: Table 2.1 shows the numbers of respondents of each sex in each disability group.

Table 2.1: Disability Groups: Numbers of Each Sex

Number (Percent)	Male	Female	Total
Wheelchair users	29 (45)	36 (55)	65
Stick users	33 (47)	37 (53)	70
All visually	22 (51)	21 (49)	43
No aids	26 (57)	20 (43)	46
Total	110 (49)	114 (51)	224

2.1.2 Of wheelchair users; 58 used a manual wheelchair and the rest used an electric wheelchair or a scooter. The normal means of propelling the manual wheelchair was determined for 43 (74%) of the wheelchair users; 16 (37%) normally propelled themselves, and the other 27 (63%) were normally pushed by some other person. Few of the normal pushers were involved in the exercise (although all were invited) and 23 (53%) of the wheelchair users were propelled during the exercise by the interviewers or some person other than the wheelchair user's normal pusher.

2.1.3 Of the 70 stick users involved in the observation work, 61 (87%) used one stick, and the remainder used two sticks.

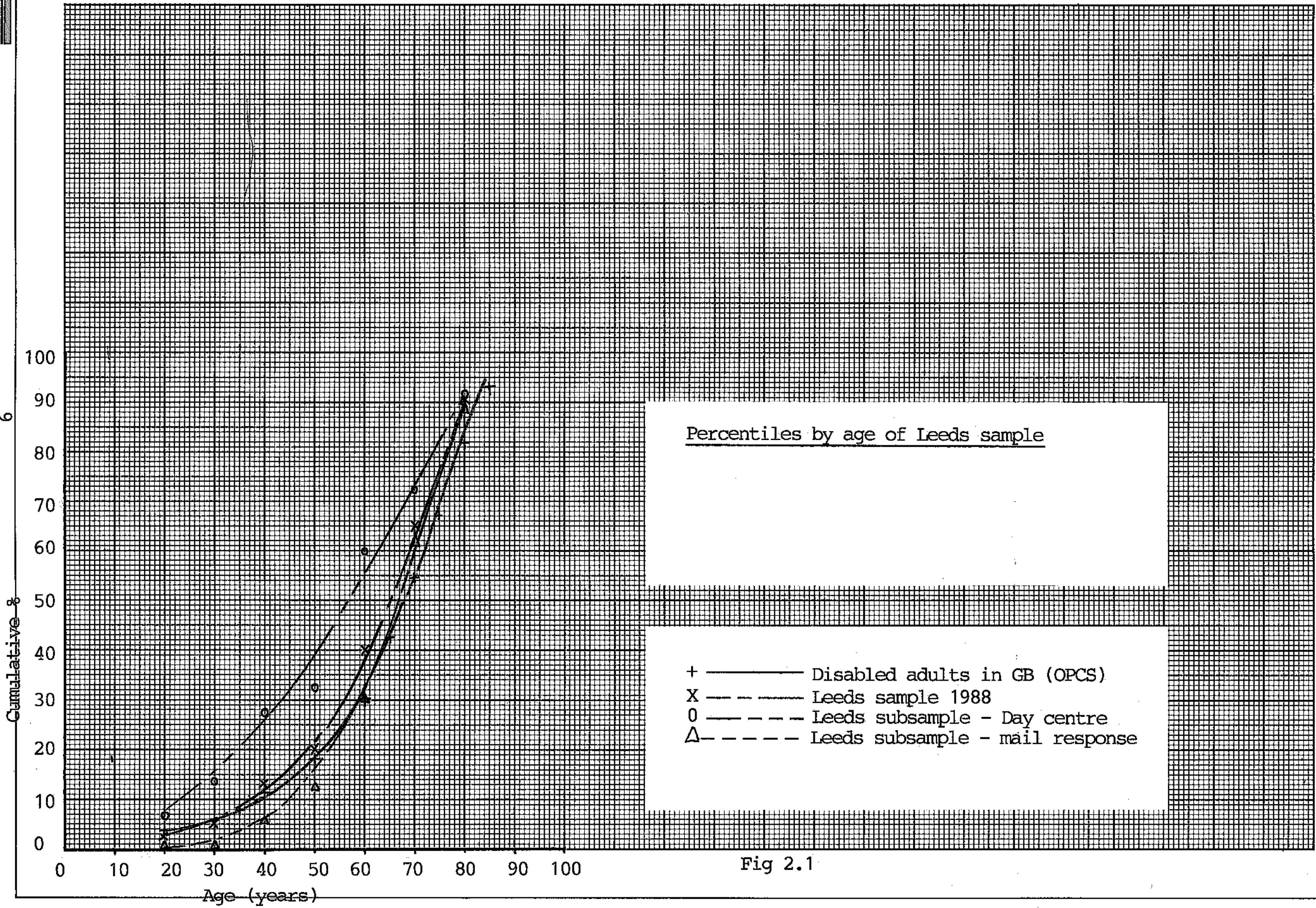
2.1.4 Of the visually handicapped participants, 64% assessed themselves to be partially sighted and 36% blind. 16 (37%) used a white stick, 11 (26%) used a white cane, and 3 (7%) used a guide dog. The remaining 13 (30%) used no aids.

2.1.5 46 participants did not use any aid, but had a variety of disabling ailments, of which 14 (30%) had arthritis or some skeletal complaint. (The visually handicapped participants who used no aid are not considered within this disability group).

2.1.6 The age of participants was determined and compared to OPCS figures for disabled adults in GB. The sample of participants was drawn from two sources, respondents to a mail shot, and participants drawn from Day Centres. The age structure of these subgroups are compared to each other, and to the OPCS figures in Figure 2.1. This shows that the respondents to the mail shot are generally older than the participants drawn from Day Centres, but that when these two subsamples were combined they give a sample that closely followed the OPCS results.

2.2 Frequency of Going Out, and Distances Moved

2.2.1 Participants were asked a number of questions relating to how often they went out, and how far they could move. The results, in Table 2.2, show that wheelchair users get out of their house least, nearly half of wheelchair users go outside their house about once per week or less often. Visually handicapped respondents go outside their house most often, about 80% go out every day or most days. Stick users and those with no aids go out almost as frequently.



Percentiles by age of Leeds sample
+ Disabled adults in GB (OPCS)
X Leeds sample 1988
0 Leeds subsample - Day centre
Δ Leeds subsample - mail response
Cumulative %
0
10
20
30
40
50
60
70
80
90
100
Age (years)

Fig 2.1

Table 2.2: Number and Percent of Participants Going Out of Their Houses

Number (Percent)	Frequency of Going Out (See Key) 1	2	3	4	5	TOTAL
Wheelchair users	13 (20)	23 (35)	21 (32)	4 (6)	4 (6)	65
Stick users	19 (27)	32 (46)	12 (17)	4 (6)	3 (4)	70
All visually handicapped	21 (49)	15 (35)	4 (9)	2 (5)	1 (2)	43
No aids	19 (41)	15 (33)	12 (26)	0 (0)	0 (0)	46
Total	72	85	49	10	8	224

Key:
1 Every day
2 Most days
3 About once a week
4 About once per month
5 Much less often

2.2.2 Table 2.3 shows that the participants travel to the city centre of Leeds relatively infrequently. About two thirds of wheelchair users, and about one half of the other groups, go to the city centre 'much less often' than once per month. The group that uses the city centre most frequently is the visually handicapped group: about one quarter using the city centre every day or most days.

<u>Table 2.3: Number and Percent of Participants Going to City Centre</u>

Frequency (percent)	Frequency of Going to City Centre (SeeKey) 1	2	3	4	5	TOTAL
Wheelchair users	2 (3)	6 (9)	6 (9)	8 (12)	43 (66)	65
Stick users	0 (0)	5 (7)	15 (21)	12 (17)	38 (54)	70
All visually handicapped	3 (7)	8 (19)	7 (16)	3 (7)	22 (51)	43
No aids	2 (4)	4 (9)	9 (20)	10 (22)	21 (46)	46
Total	7	23	37	33	124	224

Key: 1 Everyday
2 Most days
3 About once per week
4 About once per month
5 Much less often

The level of assistance required when participants go outside their homes was investigated and is shown in Table 2.4. About two thirds of wheelchair users said that they must always have someone to assist them: very few wheelchair users said that they did not need any assistance. About one sixth of 'one stick' users, and those using no aids, said that they had to have someone to assist them, and about one third of the visually handicapped participants indicated that they had to be assisted.

Table 2.4: Assistance Required When Going Outside

Frequency (Percent)	Must have assistance	Assistance useful	No assistance	TOTAL
Wheelchair users	44 (68)	17 (26)	4 (6)	65
Stick users	13 (19)	29 (41)	28 (40)	70
All visually handicapped	14 (33)	12 (29)	16 (38)	42
No aids	8 (17)	14 (30)	24 (52)	46
Total	79	72	72	223

2.2.4 Participants were asked the maximum distance that they considered that they were able to move, if assisted, between pauses for rest. From the answers provided Table 2.5 has been drawn up, showing the cumulative numbers and percentages who would have considerable difficulty in moving greater distances if provision for resting was not provided.

2.2.5 Table 2.5. demonstrates, for instance, that 24 (55%) of participants who used no aid could move no further than 150 yds without a rest and this includes 15 (34%) who could move no further than 75 yds. This in turn includes the 5 (11%) who could move no further than 20 yds.

Table 2.5: Cumulative Number of Respondents Stating That They Were Unable To Travel Distances Greater Than Those Shown, Without a Rest Even With Assistance

Frequency Percent	Number unable to move further than 20 yards (18.3m)	Number unable to move further than 75 yards (68.6m)	Number unable to move further than 150 yards (137m)	Number able to move further than 150 yards (137m)	Total Responding
Wheelchair users	5 (8)	7 (11)	13 (20)	52 (80)	65
Stick users	6 (9)	25 (37)	52 (76)	16 (24)	68
All visually handicapped	3 (7)	8 (18)	17 (40)	26 (60)	43
No aids	5 (11)	15 (34)	24 (55)	20 (45)	44

2.2.6 With regard to wheelchair users part of the difficulty in moving relates to the pusher when the wheelchair user is not self propelling.

2.2.7 Estimating distances accurately can be difficult. This potential source of error must be borne in mind when interpreting this and Table 2.6.

2.2.8 Participants were also asked to indicate how far they could travel without a rest when no assistance was available. The results are shown in Table 2.6.

Table 2.6: Cumulative Numbers of Respondents Stating That They Were Unable to Travel Distances Greater Than Those Shown, Without Taking Rest, Without Assistance

Number Percent	Must have assist -ance	Maximum of 20 yards (18.3m)	Maximum of 75 yards (68.6m)	Maximum of 150 yards (137m)	Can Move further than 150 yds	Total respond -ing
Wheelchair users	44 (69)	45 (70)	45 (70)	49 (76)	15 (23)	64
Stick users	13 (19)	19 (28)	31 (46)	48 (72)	19 (28)	67
All visual handicap	14 (34)	15 (37)	16 (39)	18 (44)	23 (56)	41
No aids	10 (23)	13 (30)	21 (48)	27 (61)	17 (39)	44

2.2.9 In the whole group of participants who said that assistance would be useful, or that they needed no assistance, there are 18 people who indicated that they could travel greater distances without assistance than with assistance. From the results set out in Table 2.5 and 2.6, it will be noticed that a few participants indicated that they could travel further without, rather than with, assistance.

3. MOVEMENT DISTANT EXERCISE

3.1 Introduction

3.1.1 In the first part of the observation survey participants were asked to travel around an essentially level circular route of 180m while they were being timed. Participants were advised that, although they would be timed they were not to attempt to travel as fast as they could, but to proceed at their ordinary pace, and to take rests whenever they wished. At the end of the route, participants were asked how the distance they had just travelled compared to normal trips to the city centre, and whether they would be willing to travel around the route a second time. If they were willing, they then travelled round the course again, and at the end were asked again how the distance compared to normal visits. Participants normally moved singly, without assistance, to avoid the possible effect of a group adjusting its pace to the slowest, or an individual attempting to compete with other participants. A St John Ambulance officer was in attendance at all times. Interviewers stayed at some distance from the participant, so as not to affect the pace of progress while being able to make timings. Where a participant requested assistance, it was provided in the first instance by the interviewer, or by the St John Ambulance attendant. Participants were fitted with unobtrusive tape recorders into which any comments they wished to make about the course or feelings of fatigue could be recorded.

3.1.2 During the course of the various activities undertaken, participants were offered refreshment, sometimes before and sometimes after the movement distance exercise. There was some concern that the time the movement distance times would be affected by participants having taken or not taken refreshments before the exercise. Consequently, the mean times of each disability group, and the standard deviation (a measure of the expected variation on that time) was found. From Appendices A and B it can be seen that this fear is unfounded.

3.2 The Results of Timings and Rests

3.2.1 The total number of rests (excluding non-rest pauses) each participant took is given in Table 3.1, and reflects the fact that few wheelchair users stopped for a rest, unsurprisingly in view of the large number of pushers provided by the researchers. All but one of the 5 wheelchair users taking pauses were participants who were propelling themselves.

Table 3.1: Numbers Starting, Completing and Taking Rests During Movement Distance Exercise

Frequency/ percentage	Total number invited to take part*	Number starting first route**	Number starting without completing first route	Number starting but not completing second route	Number of rests taken over both routes 0	1	2	3	4 -6
Wheelchair users	62	62	2	0	55	4	0	0	1
Stick users	68	61	2	1	28	15	9	4	2
All visually handicapped	43	42	0	0	40	1	1	0	0
No aids	44	42	0	0	32	6	2	1	1

* The balance up to total involved in survey is comprised of those not taking part due to inclement weather, lack of time, or for unrecorded reasons.

** A number of participants declined to take part because they considered the distance too great or on the advice of St John Ambulance Officer.

3.2.2 Few visually handicapped participants took rest pauses. About one quarter of participants who used no aid took at least one rest, but two fifths of participants who used one stick rested. Usually only one rest was taken, only in the case of the stick users did more than 10% of any disability group take more than one pause. Participants who used two sticks were not shown to be more or less likely to take a pause than participants using one stick.

3.2.3 The position of the first rest pause taken by participants is shown in Table 3.2.

Table 3.2: Number of respondents taking their first rest pause in the section shown

Number	First Time Round 1st sect 0-42.5m	2nd sect 42.5-85m	3rd sect 85-95m	4th sect 95-137.5m	5th sect 137.5-180m
Wheelchair users	2	2	0	0	1
Stick users	5	6	2	8	5
All visually handicapped	0	0	0	1	0
No aids	2	2	1	3	2

Number	Second Time Round 1st sect 180-222.5m	2nd sect 222.5-265m	3rd sect 265-275m	4th sect 275-317.5m	5th sect 317.5-360m
Wheelchair users	0	0	0	0	0
Stick users	1	1	1	1	0
All visually handicapped	0	0	0	1	0
No aids	0	0	0	0	0

3.2.4 The time taken to travel around the route the first time is shown in Figure 3.1., and clearly indicates that wheelchair users, visually handicapped participants, and those who used no aid took about the same time, with a few fast wheelchair users.

3.2.5 Most stick users were much slower, taking a median time 1.5 times longer than the other groups. All groups had a small number of participants, represented by the long "tail" in Figure 3.1, who took considerably longer than the median time.

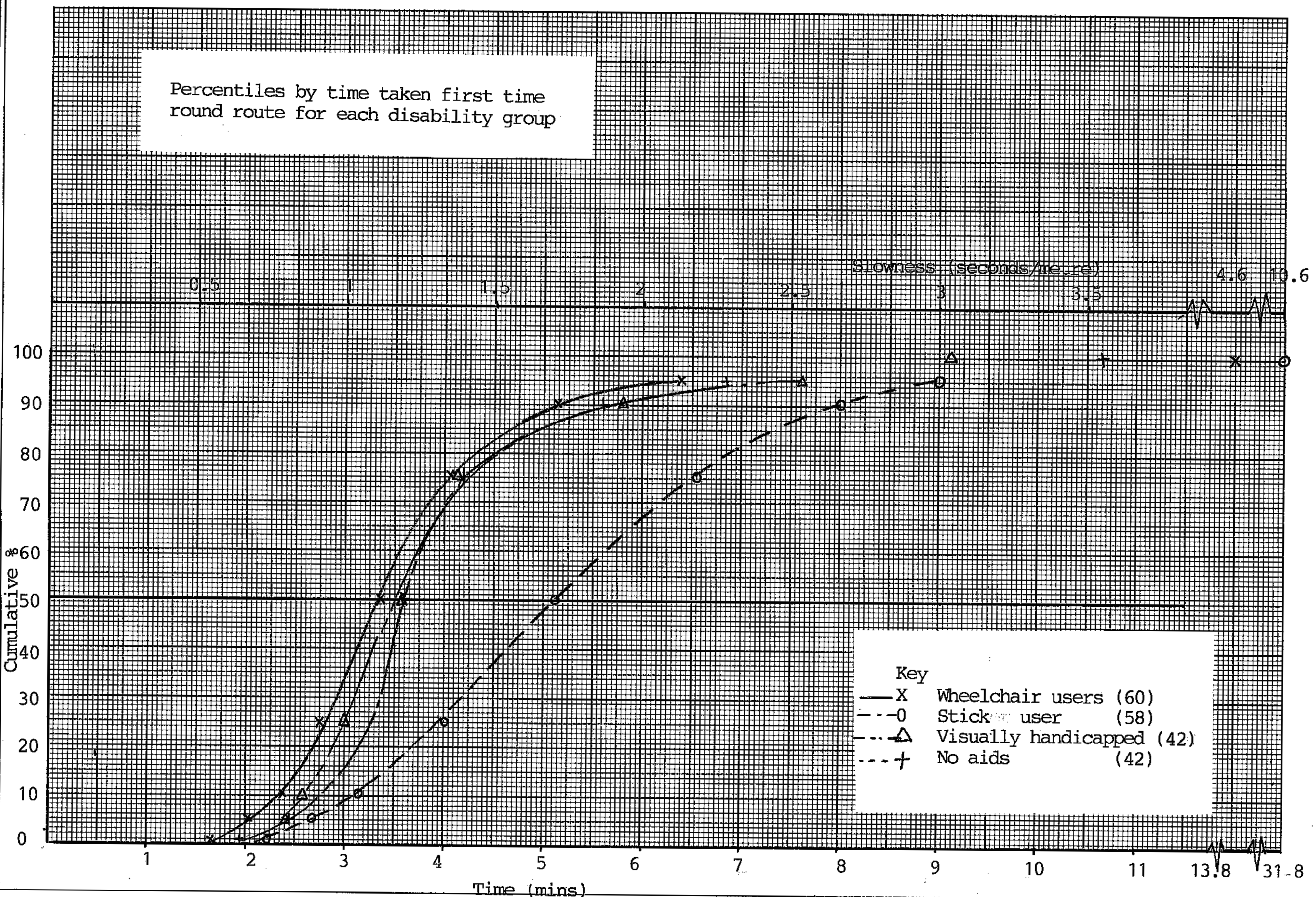

Percentiles by time taken first time round route for each disability group
Slowness (seconds/metre)
0.5
1
1.5
2
2.5
3
3.5
4.6
10.6
Cumulative %
100
90
80
70
60
50
40
30
20
10
0
Key
Wheelchair users (60)
Stick user (58)
Visually handicapped (42)
No aids (42)
1
2
3
4
5
6
7
8
9
10
11
13.8
31.8
Time (mins)

Fig 3.1

3.2.6 The 10th percentile time, the greatest time taken by the fastest 10 percent of participants in a disability category, varied between 0.6 seconds per metre for wheelchair users, and 1.1 seconds per metre for stick users. The median times varied between close to 1.2 seconds per metre for wheelchair users, those using no aid and visually handicapped participants, and 1.7 seconds per metre for stick users. The 90th percentile time, the least time taken by the slowest 10 percent, varied between 1.7 seconds per metre for wheelchair users and 2.6 seconds per metre for stick users.

3.2.7 The time taken by those participants in each disability group, based on whether participants moved over the route a second turn or not is shown in Figure 3.2. This figure shows that participants who were able to travel around the course a second time generally moved faster than participants who travelled around only once.

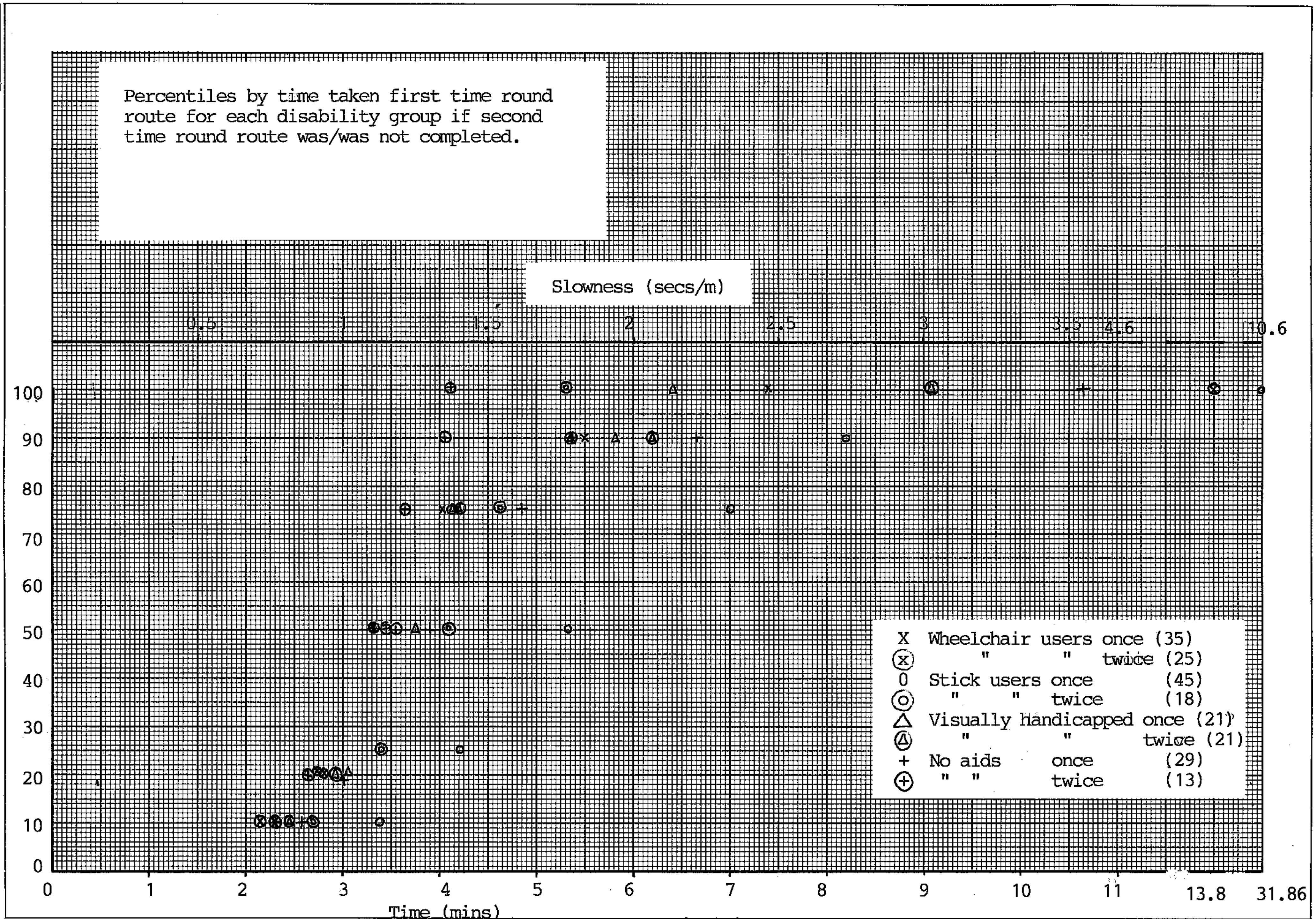
3.2.8 Figure 3.3 shows the link between the speed of visually handicapped participants and the need for assistance. Those participants requiring no assistance were able to move faster than those requiring assistance or those who found assistance useful. Table 3.3 demonstrates the same point in tabular form.

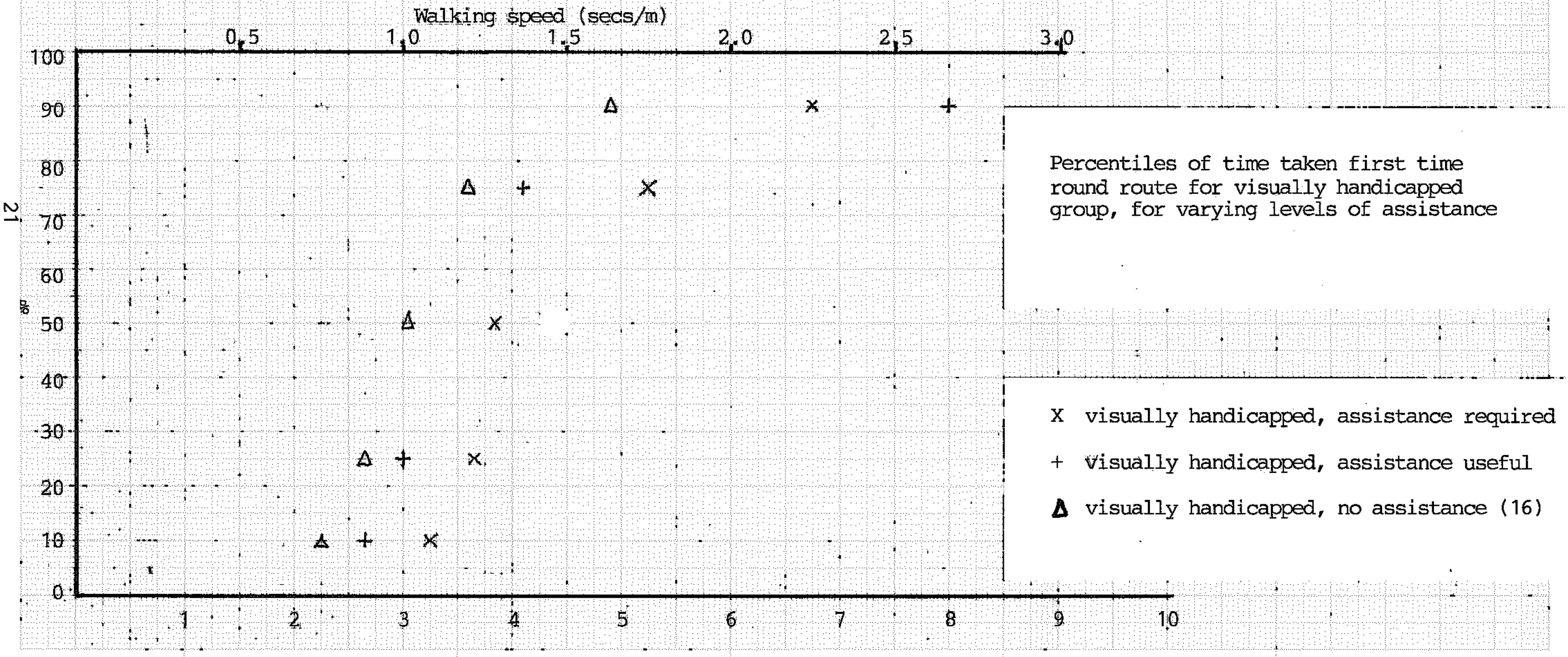
Table 3.3

Times Taken by Visually Handicapped Participants for Varying Levels of Assistance to Complete first 100m Circuit

Percentiles	Assistance Required (N = 13) (minutes)	Assistance Useful (N = 12) (minutes)	No Assistance Needed (N = 16) (minutes)
10	3.27	2.68	2.26
50	3.87	3.81	3.01
90	6.73	7.80	4.88

3.2.9 In Figure 3.4 the movement-distance times are presented for subgroups of the main disability categories, where the participant's subgroup was known. For wheelchair users the times taken by wheelchair users propelling themselves has been shown separately from those wheelchair users who were pushed or used electrically powered wheelchairs.


Percentiles by time taken first time round route for each disability group if second time round route was/was not completed.
Slowness (secs/m)
0.5
1
1.5
2
2.5
3
3.5
4.6
10.6
100
90
80
70
60
50
40
30
20
10
0
%
0
1
2
3
4
5
6
7
8
9
10
11
13.8
31.86
Time (mins)
X Wheelchair users once (35)
" " twice (25)
0 Stick users once (45)
" " twice (18)
Visually Handicapped once (21)
" " twice (21)
+ No aids once (29)
" " twice (13)
Fig 3.2



Walking speed (secs/m)
0.5
1.0
1.5
2.0
2.5
3.0
100
90
80
70
60
50
40
30
20
10
0
%
1
2
3
4
5
6
7
8
9
10
Time (mins)
Percentiles of time taken first time round route for visually handicapped group, for varying levels of assistance
X visually handicapped, assistance required
+ visually handicapped, assistance useful
Δ visually handicapped, no assistance (16)

Fig 3.3

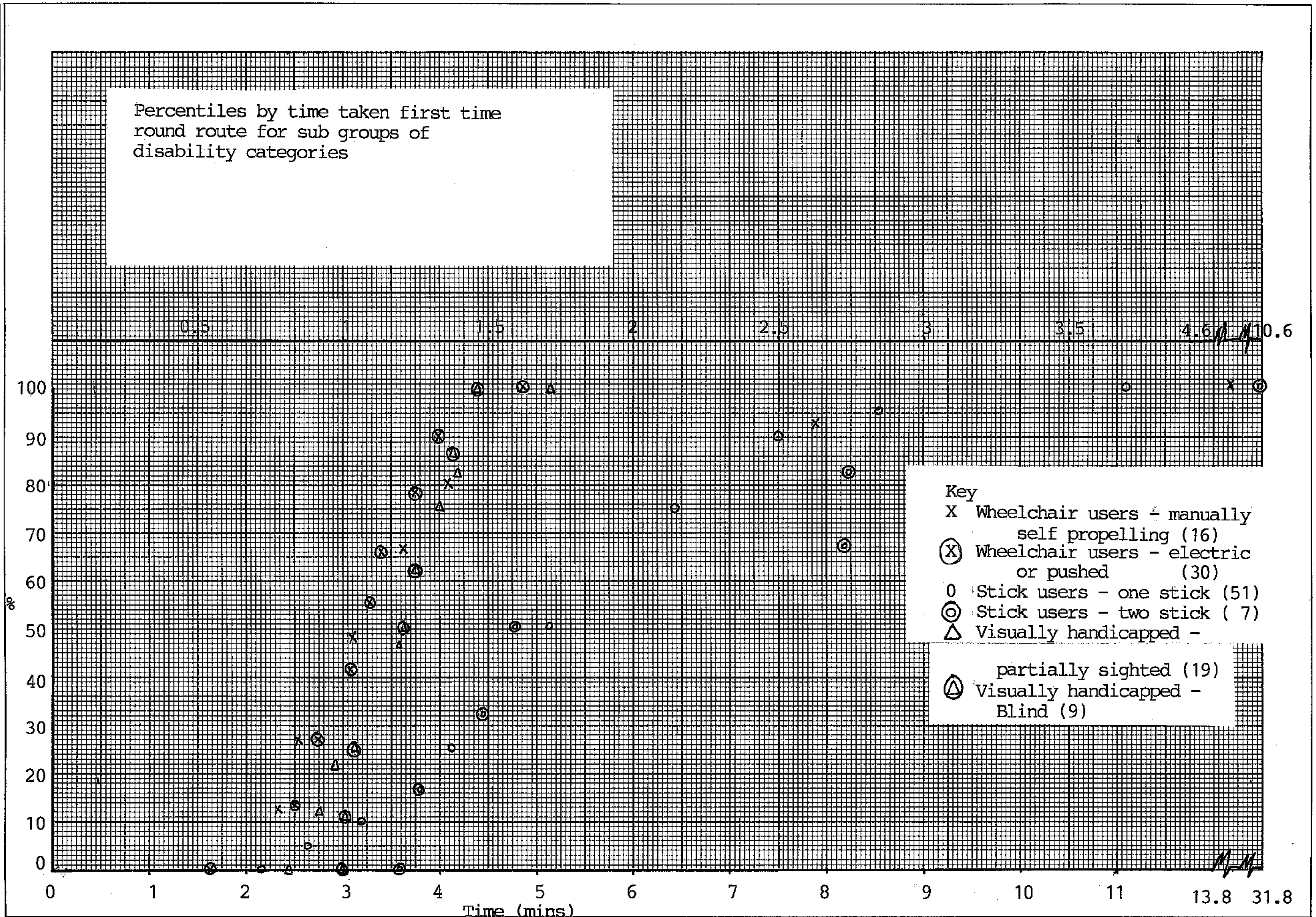

Percentiles by time taken first time
round route for sub groups of
disability categories
0.5
1
1.5
2
2.5
3
3.5
4.6
10.6
100
90
80
70
60
50
40
30
20
10
0
%
0
1
2
3
4
5
6
7
8
9
10
11
13.8
31.8
Time (mins)
Key
X Wheelchair users - manually
self propelling (16)
(X) Wheelchair users - electric
or pushed (30)
0 Stick users - one stick (51)
◎ Stick users - two stick (7)
△ Visually handicapped -
partially sighted (19)
(△) Visually handicapped -
Blind (9)

Fig 3.4

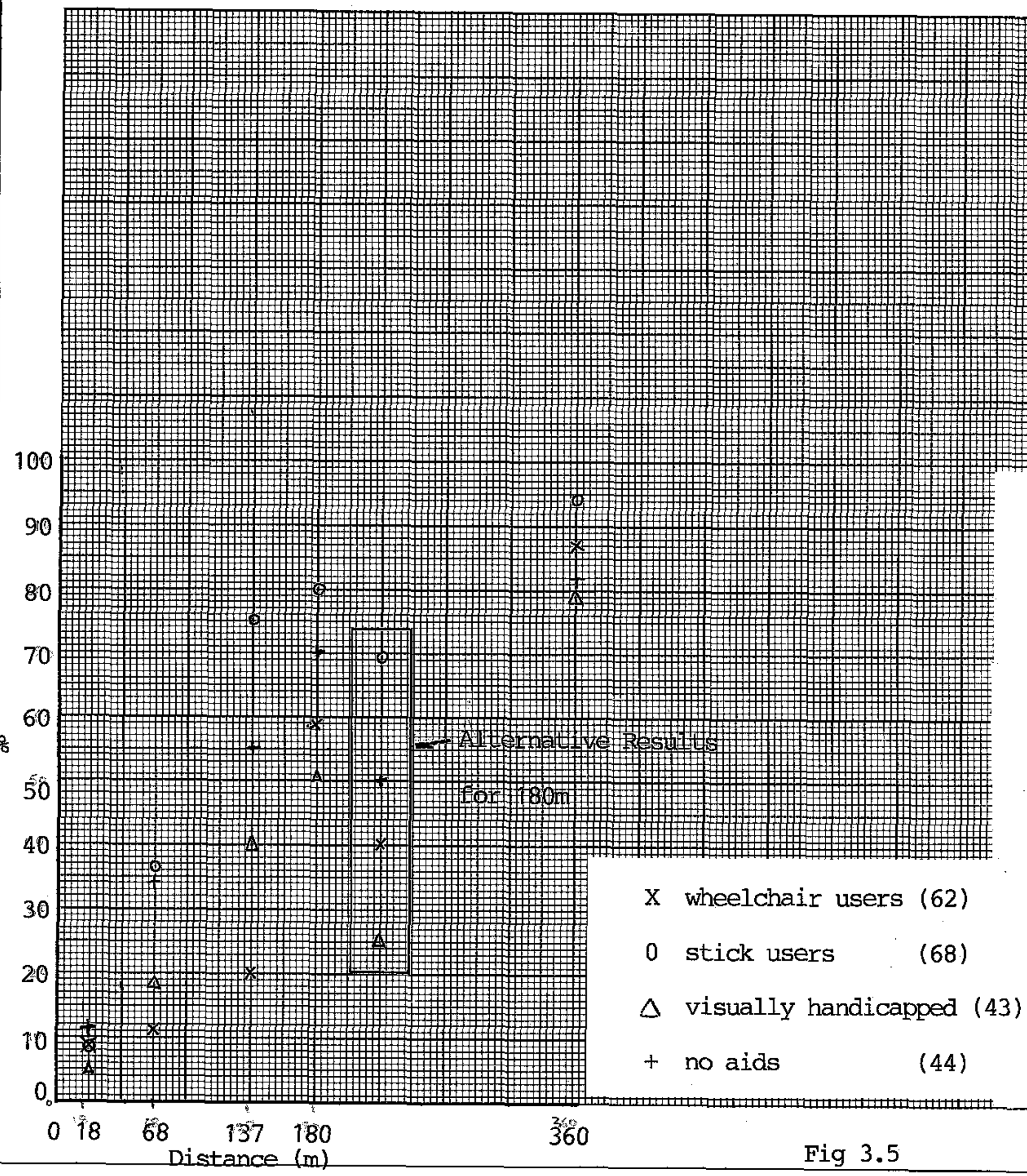
3.2.10 The number of participants who considered that the route shown to them at the start of the movement-distance exercise was too long was recorded. After participants had moved around the route once they were asked whether the distance they had covered was not as far, about the same, or further than they would normally manage. Participants were then asked if they were willing to move around the course a second time. If they were willing, they went around the course a second time, and were then asked again whether the distance they had covered was not as far, about the same or further than they would normally manage.

3.2.11 The numbers of participants who said that the route was too long to go round once, or where the St John Ambulance attendant thought it unwise for the participant to attempt the route, or where participants started moving around but returned without going the full route, were identified and are shown in column A of Table 3.4.

3.2.12 Participants who travelled around the 180 m route once, and said that that was as far or further than they would normally go are recorded in column B of Table 3.4. A number of participants went round the route once, and said they could have gone further, but declined to do so. These are recorded in column C of the Table. Participants who went around the course twice, a distance of 360m, and then said that that was as far or further than they normally would move are recorded in column D. Some participants said that they could have gone still further and these are recorded in column E.

3.2.13 The total number taking part in the movement distance exercise are recorded in column F. A small number of participants were not invited to take part because of time constraints, or declined to take part because of inclement weather, which accounts for the difference in number between the number taking part in the movement-distance exercise, and the number who were brought into the city centre.

3.2.14 Table 3.4 was used in drawing up Figure 3.5. Participants who could not complete the first round, in column A, and for whom once round was enough, in Column B, were shown as excluded from travelling further than 180m. For example, in the case of stick users, 10 participants did not manage the first time round, and 45 participants travelled round once only. These 55 participants would be unable to travel further than 180m. (Of course some would not be able to travel as far). These 55 represent 81% of stick users in the exercise, and so it is recorded in Figure 3.5 that 81% of one stick users are



Percentiles excluded from moving further than distance shown

Notes

1. Results for 18m 68m and 137m are drawn from table F, which considers stated distances moved without a rest. Results for 180m and 360m are drawn from movement distance exercise.
2. Alternative results for 180m take into account participants who moved around route once only, but said they could move further.

Fig 3.5

excluded from distances greater than 180m.

3.2.15 Participants who went on to travel around the route a second time and who then said that that was as far or further than they normally went were considered to be excluded from travelling further than 360m. In the case of stick users there were 9 participants who went round twice but would go no further. These 9 plus the 55 who would travel no further than 180m represent 94% of stick users, and are shown on the Figure 3.5 as being excluded from travelling further than 360m.

3.2.16 A number of participants shown on column B went around the course once and said that they would normally travel further, but, in practice, declined to do so, as described earlier. The results of considering that this group would not be excluded from travelling 180m are shown as an 'alternative' result for 180 m.

Table 3.4: Number of Participants Completing Different Distances During Movement Distance Exercise

	A	B	C	D	E	F
	Participants saying distance too great, or starting but not completing first route	Total number of participants going around once only (180m)	Participants going around once only (180m) but saying they could go further**	Participants going around twice (360m) but saying that but was as far or further than they would normally travel	Participants saying they could go further	Total involved in movement distance exercise*
Wheelchair users	2	35	12	17	8	62
Stick users	10	45	8	9	4	68
Visually handicapped	1	21	11	11	10	43
No Aids	2	29	9	5	8	44

* The balance up to total brought into the city centre is comprised of those not taking part due to inclement weather, lack of time, or for unrecorded reasons.

** Participants in this column are also in column B.

26

3.2.17 The presentation of two sets of results for 180m highlights the problem of determining the distance that a person can move, as this distance is partly determined by the participant's motivation. It may also be that participants were unwilling to acknowledge the extent to which their ability to cover distance is limited.

3.2.18 In Table 2.6 the cumulative numbers of respondents stating that they were unable to travel distances greater than 18 m, 68 m and 137 m are shown. This information is also shown in Figure 3.5, and demonstrates consistency with the results obtained from the movement distance exercise.

3.3 <u>Comments made During Movement Distance Exercise</u>

3.3.1 Participants in the movement distance exercise were asked to comment on the route or their feelings of fatigue as they moved around it. Interviewers were instructed to be careful not to lead participants to make any particular type of comment, so that matters raised would be those which participants thought relevant. For this purpose participants were fitted with small tape recorders and microphones. 167 successful recordings were made in this way of which 126 included at least one comment. The remainder of tape recordings failed for a variety of reasons such as the microphone inadvertently becoming detached from the tape recorder.

3.3.2 Comments received were divided into categories related to seating, pavements, obstructions and 'other'. Up to five separate comments from each participant was noted.

3.3.3 18 favourable comments were received about seating on the route, mainly from stick users, commenting that it is a good idea for seats to be provided and that there are enough of them. One participant remarked that there were not enough seats.

3.3.4 19 participants commentrd on surface uneveness at some points on the route, these comments coming from all categories of disability. 54 participants commented on camber, pointing out, for example, that it makes for difficultly in steering wheelchairs. At one point along the route there is camber of 9%. Comments on the camber were spread evenly across the disability categories.

3.3.5 13 participants commented adversely on kerbs, seven of these coming from wheelchair users. Two kerbs had to be crossed, these being 20-30mm high.

3.3.6 14 comments were noted relating to pavements being slippery, particularly when wet, and 33 comments were noted relating to cracks in the pavements or unevenness, these comments coming particularly from participants who had wheelchairs, or who were visually handicapped. However, 50 participants commented that they considered the pavements to be in good order.

3.3.7 Compared to the level of comment relating to pavements, there were few remarks relating to obstruction. 9 remarks were recorded relating to the parking of cars, and 4 remarks related to other pedestrians.

3.3.8 22 comments were received relating to street furniture, such as signs and bollards, 15 of these from visually handicapped participants; 13 participants also commented specificially on the two sets of A frames found on the course. Three visually handicapped participants stressed that obstructions should be marked by brightly coloured stripes or a change in the pavement.

3.3.9 Very few "other" comments were received, but these included signs for and provision of toilets, and the presence of litter.

4. SURFACE CONDITIONS EXERCISE

4.1 Introduction

4.1.1 In the surface condition activity each participant was taken individually to nine rectangular sites, 2 metres x 5 metres, marked out on Albion Street. Each of the sites was positioned so that the long side was orientated in the direction of flow in that area. The participants were asked to move along the marked areas, or to otherwise assess it. They were then asked how difficult they found moving over the area, and whether they considered that moving over the marked area represented a risk of stumbling or disrupting their progress. If there was any level of difficulty or risk reported, participants were asked to indicate the cause of difficulty, ie, whether it was gaps between pavers, the slope of the pavement, camber, general unevenness, slipperiness or something else. Any of the possibilities that were mentioned by the participant as a cause of difficulty were noted, as was the nature of any other difficulty.

4.1.2 Each site was measured for a number of characteristics: gaps, height differences between pavers, undulation, camber, slope and surface friction. The values obtained for each characteristic at each site was then compared with the frequency of comments of difficulty.

4.2 Gaps

4.2.1 The length of gaps of >5 mm, 5-10 mm, 10-20 mm, 20-30 mm and >30 mm width was measured in each of the 2m x 5m rectangles, when the depth of the gap was >5 mm.

4.2.2 In Figures 4.1.1 - 4.1.4 the total length of gap > 10 mm of each site has been marked along the horizontal axes, and the percentage of each disability group mentioning gaps as causing a problem marked on the vertical axis.

4.2.3 The results for each disability group are remarkably similar, and show a very clear relationship between the length of gaps at each site and the frequency with which gaps were mentioned as causing difficulty.

4.2.4 Two sites consistently do not fall in with the relationship. These are sites 7 and 8. These two sites are shown as having the greatest lengths of gaps, but did not have the greatest numbers of participants mentioning gaps as a problem. The most probable explanation is that both sites contain a high proportion of brick, and in the brick sections the gap between the brick was generally just over 10 mm wide and 5 mm deep, and the pointing was in need of repair. It appears that this gap dimension was not generally seen as a problem, and it was only larger gaps that caused participants to say that they found the gaps a problem.

4.2.5 The principal difference between the groups is that stick users tended to mention gaps as a problem more often than the other groups.

4.2.6 In Figures 4.2.1 - 4.2.4 the length of gaps > 20mm wide is compared with the difficulty found by participants. The Figures show a clear relationship apart from two sites that consistently do not fit the relationship (Sites 1 and 8). The sites that do not fit into the relationship are those that include grates.

4.2.7 The length of gaps >5mm is also shown compared to difficulty found by participants in Figures 4.3.1 - 4.3.4.

4.2.8 The three sets of figures showing length of gap >5 mm, 10 mm, and 20 mm were compared. The most consistent relationship between length of gap and degree of difficulty expressed by respondents was found to be given by the length of 10 mm gaps.

4.3 Undulation

4.3.1 A grid with 0.5 m nodes was laid out over the 2 m x 5 m rectangle and the difference in height between the level of the pavement and an horizontal plane measured. The data were used to generate a 'best fit' hypothetical plane, and the difference between the best fit plane and the pavement measurements was used to describe the extent of undulation in the rectangle. This method is described more fully in Working Paper 255. The comparison between the measurements made and the frequency with which undulation was mentioned as a problem is shown in Figures 4.4.1 -4.4.4.

4.3.2 The results show a clear correlation between the measure of undulation and the frequency with which unevenness was mentioned. There are three sites that, consistently, do not fall in with the general relationship, sites 2, 5 & 9. It is clear that at site 9 the level of undulation is overstated. The problem here is that the rectangle was placed across the crown of the road and if this was taken into account, a lower level of undulation would be found. Sites 2 and 5 are the other sites which do not fall in with the general pattern and there is no clear explanation of why these two sites do not fit into the general pattern.

4.4 Gradient

4.4.1 Figures 4.5.1 - 4.5.4 show that the gradient of slope used on surface condition exercise generally did not present a problem to participants. It must be remembered that these were only assessments of 5m lengths rather than difficulty found with a longer slope. It is reasonable to suppose that assessments of slopes having the same gradients as used in this part of the study but involving greater distances would be found more difficult by participants. It must also be noted that the gradients were normally downhill. In Working Paper 255, steeper and longer gradients were used and these better reflected difficulties found by participants.

4.5 Camber

4.5.1 Figures 4.6.1 - 4.6.4 show the percentage of participants finding difficulty with camber. This demonstrates that few of the cambers in the surface conditions exercise were found to cause problems. If interviewers thought participants were unclear about the meaning of the term, they were encouraged to explain the term as meaning 'the sideways slope of some pavements'.

4.5.2 The camber at site 9, of 4.5% (1:22), was found to be a problem by very few wheelchair users contrary to what was expected. It is, however, highly possible that the distance over which participants assessed the camber, 5m, was insufficient for the effect of the camber to be adequately felt. In Working Paper 255 the effects of cambers over greater distances than used here were reported.

4.6 Friction

4.6.1 In Figures 4.7.1 - 4.7.4, the percentage of participants saying the possibility of slipping can cause difficulty is compared to the skid resistance found at each site, measured using a portable skid resistance tester, as described in TRRL Road Note 27. The higher the skid resistance value, the higher is the resistance to slipping.

4.6.2 Little relationship was found between the level of skid resistance and the percentage saying that it caused difficulty. This may be because the range of skid resistances found on the various sites was narrower than in the field work reported in Working Paper 255. Generally very few respondents noted the possibility of slipping as a cause of difficulty. The disability group that reported it most frequently was the group that used sticks. For this group about 10% of respondents reported that slipping could cause difficulty.

4.6.3 The percentages stating difficulty found are also shown separately for wet and dry conditions in Figures 4.8.1 - 4.8.4. There were small sample sizes for some disability groups in wet conditions, and for thirteen respondents the weather conditions at the time of the participation were not recorded.

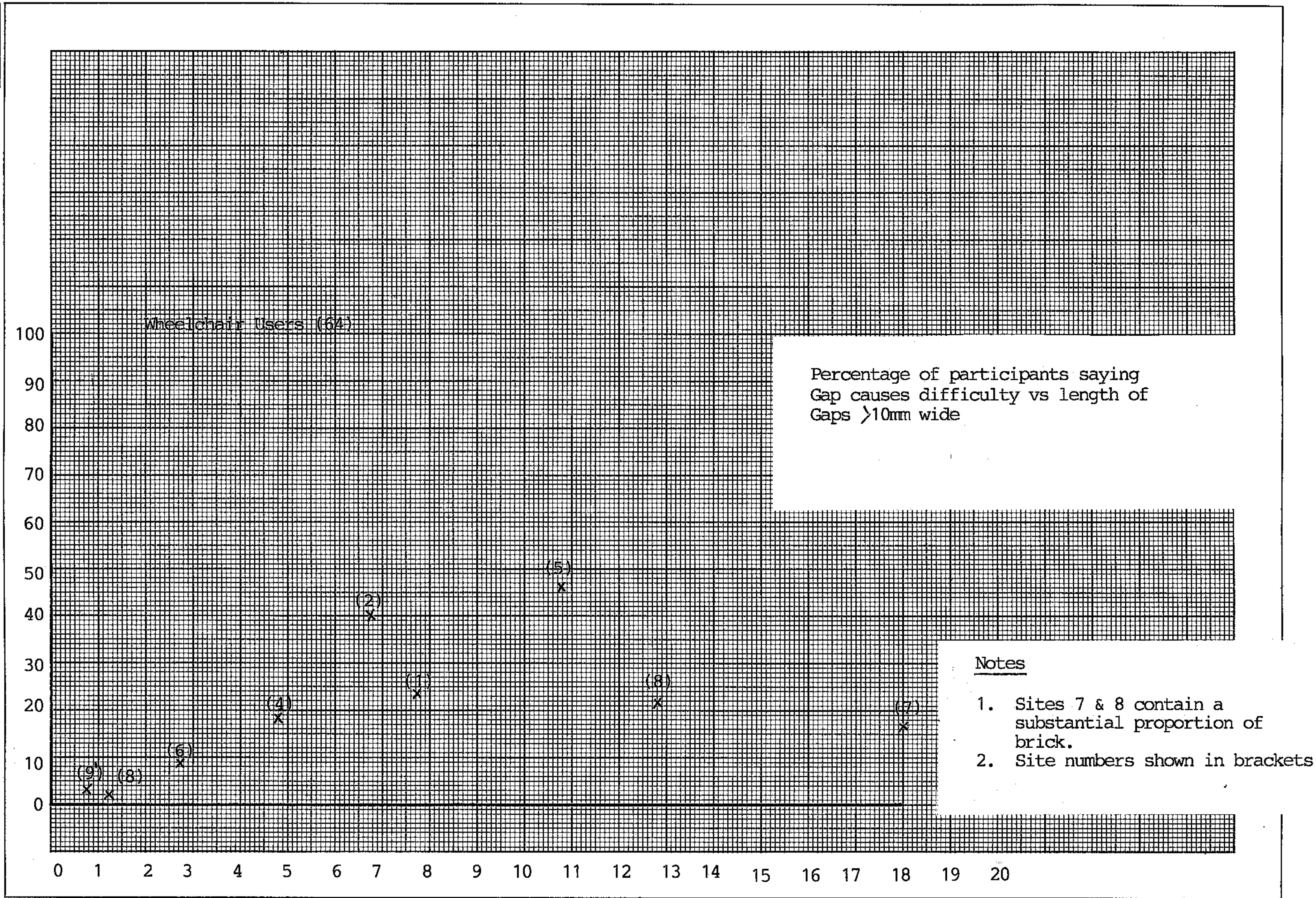
4.6.4 No relationship between the level of skid resistance and the percentage saying that the sites caused difficulty are apparent when conditions are wet or dry. However, higher levels of difficulty were generally reported when conditions are wet.

4.7 General Assessment of Each Site

4.7.1 In addition to assessing difficulty with specifically expressed impediments, such as gaps, participants were asked to assess each site generally for risk of stumbling or difficulty in moving over the marked areas. The results are shown in Figure 4.9. The figure shows that values given for risk of stumbling, or for wheelchair users 'disrupting your progress' and values given for difficulty in moving over the marked areas are similar. The results also show that each of the disability groups ranks difficulty found at each of the sites in a similar way. The greatest level of difficulty is reported consistently by the stick users.

4.8 Site Photographs

4.8.1 Appendix F shows views of the nine surface condition sites. They are presented in the general order of difficulty apparent from interpretation of Figure 4.9.



Wheelchair Users (64)
100
90
80
70
60
50
40
30
20
10
0
(9)
(8)
(6)
(4)
(2)
(1)
(5)
(8)
(7)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Percentage of participants saying Gap causes difficulty vs length of Gaps >10mm wide
Notes
1. Sites 7 & 8 contain a substantial proportion of brick.
2. Site numbers shown in brackets
Length of gap (m)

Fig 4.1.1

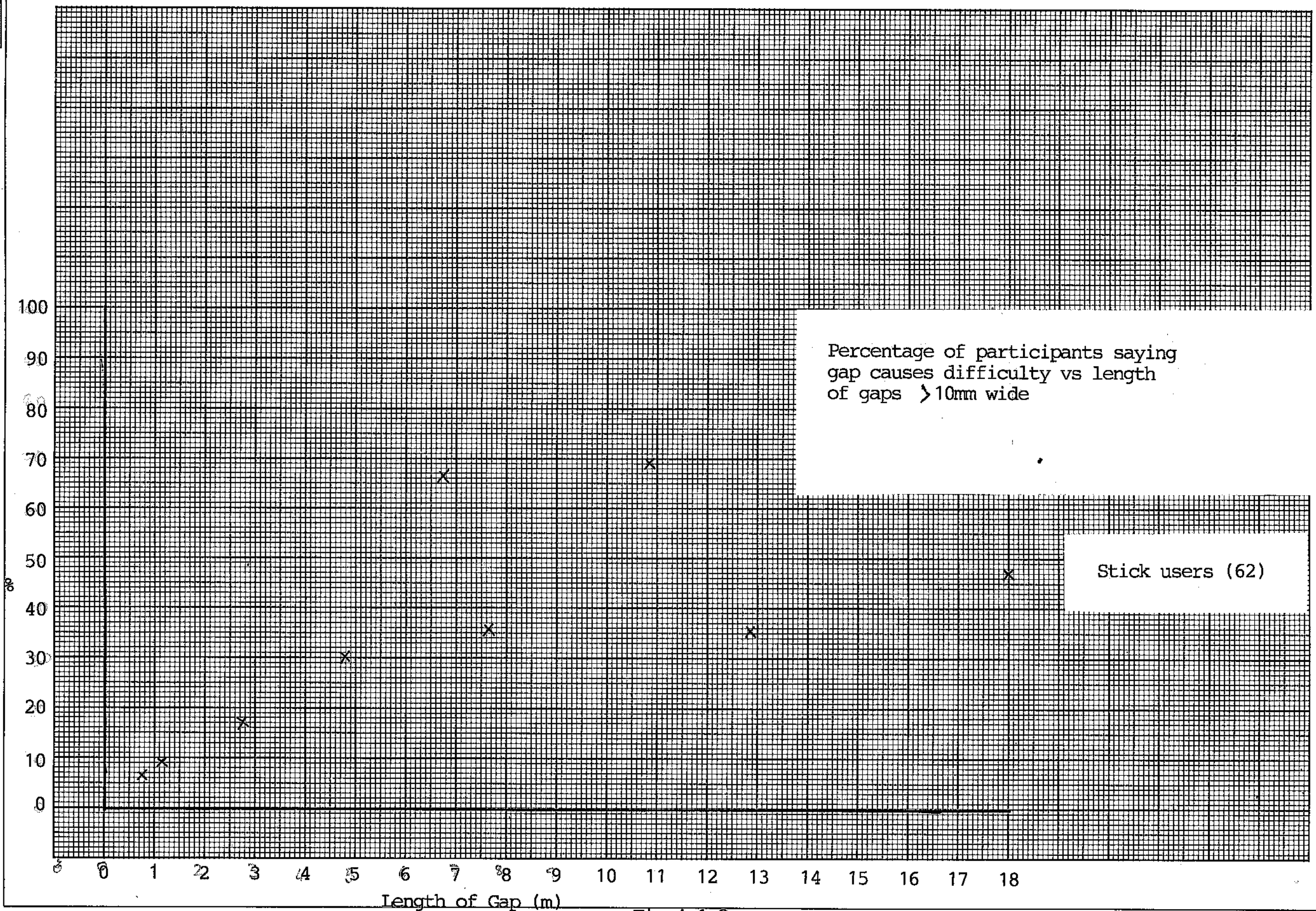

Percentage of participants saying gap causes difficulty vs length of gaps >10mm wide
Stick users (62)
%
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Length of Gap (m)

Fig 4.1.2

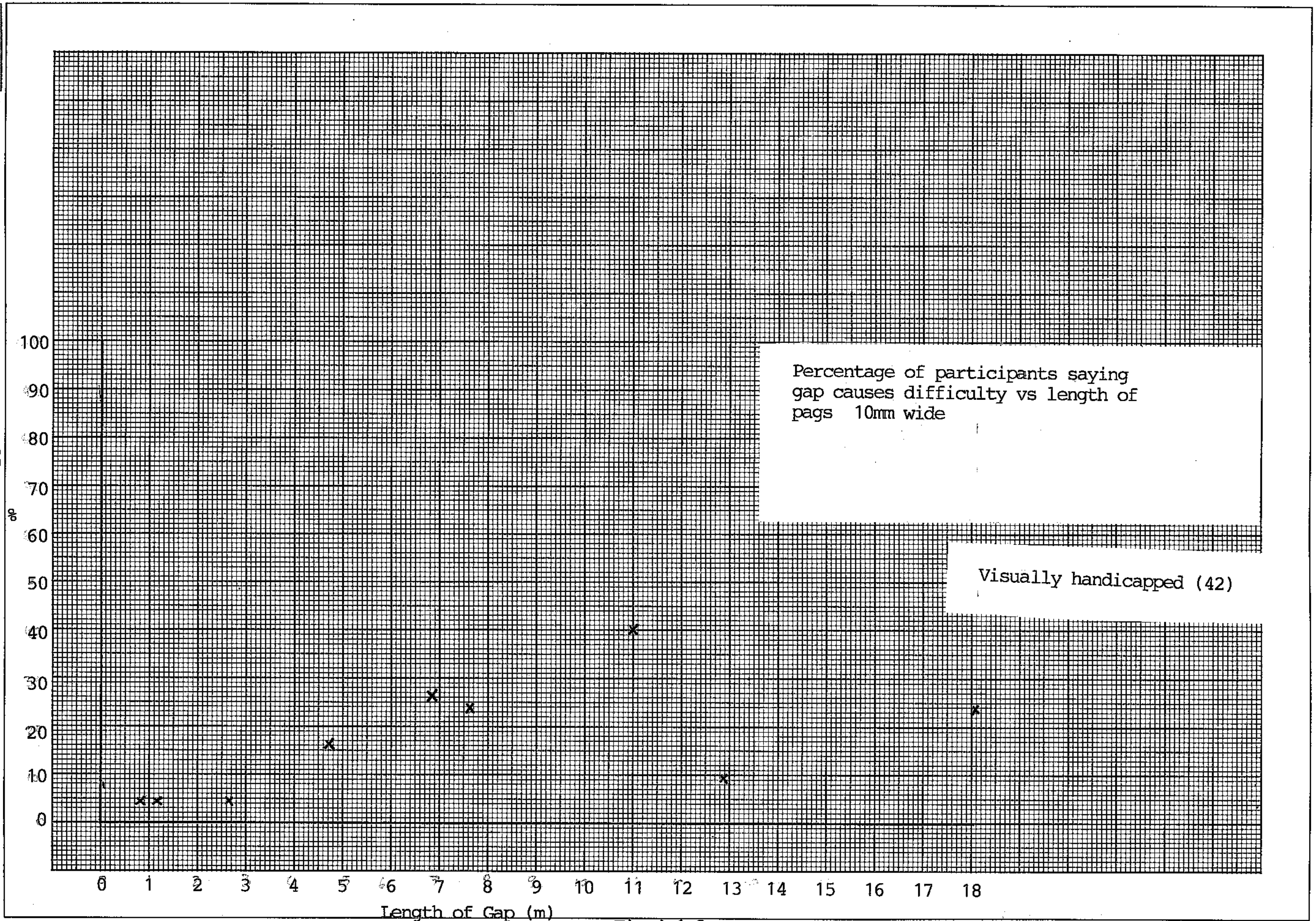

Percentage of participants saying gap causes difficulty vs length of pags 10mm wide
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Length of Gap (m)

Fig 4.1.3

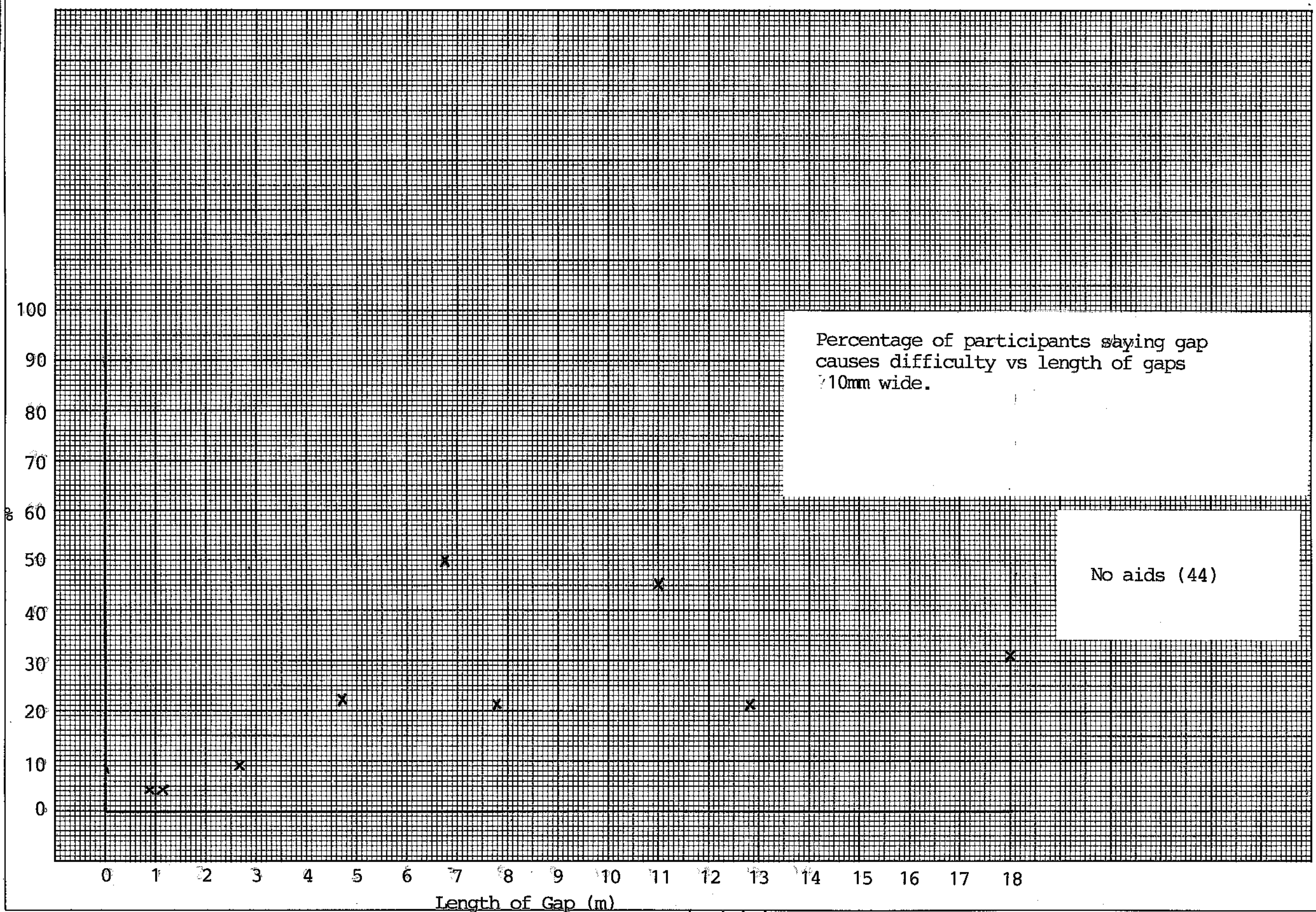

Percentage of participants saying gap causes difficulty vs length of gaps ?10mm wide.
No aids (44)
%
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Length of Gap (m)

Fig 4.1.4

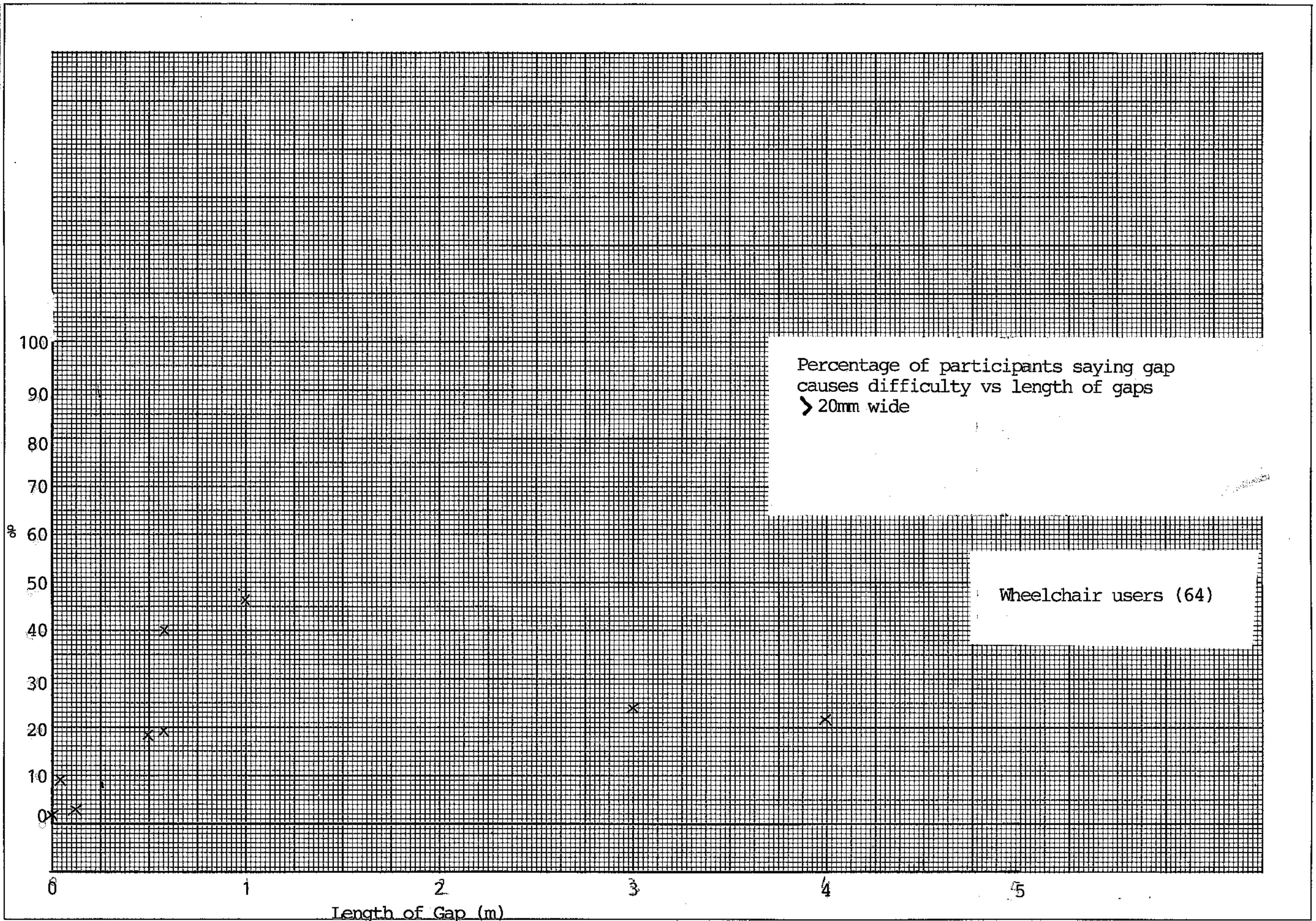
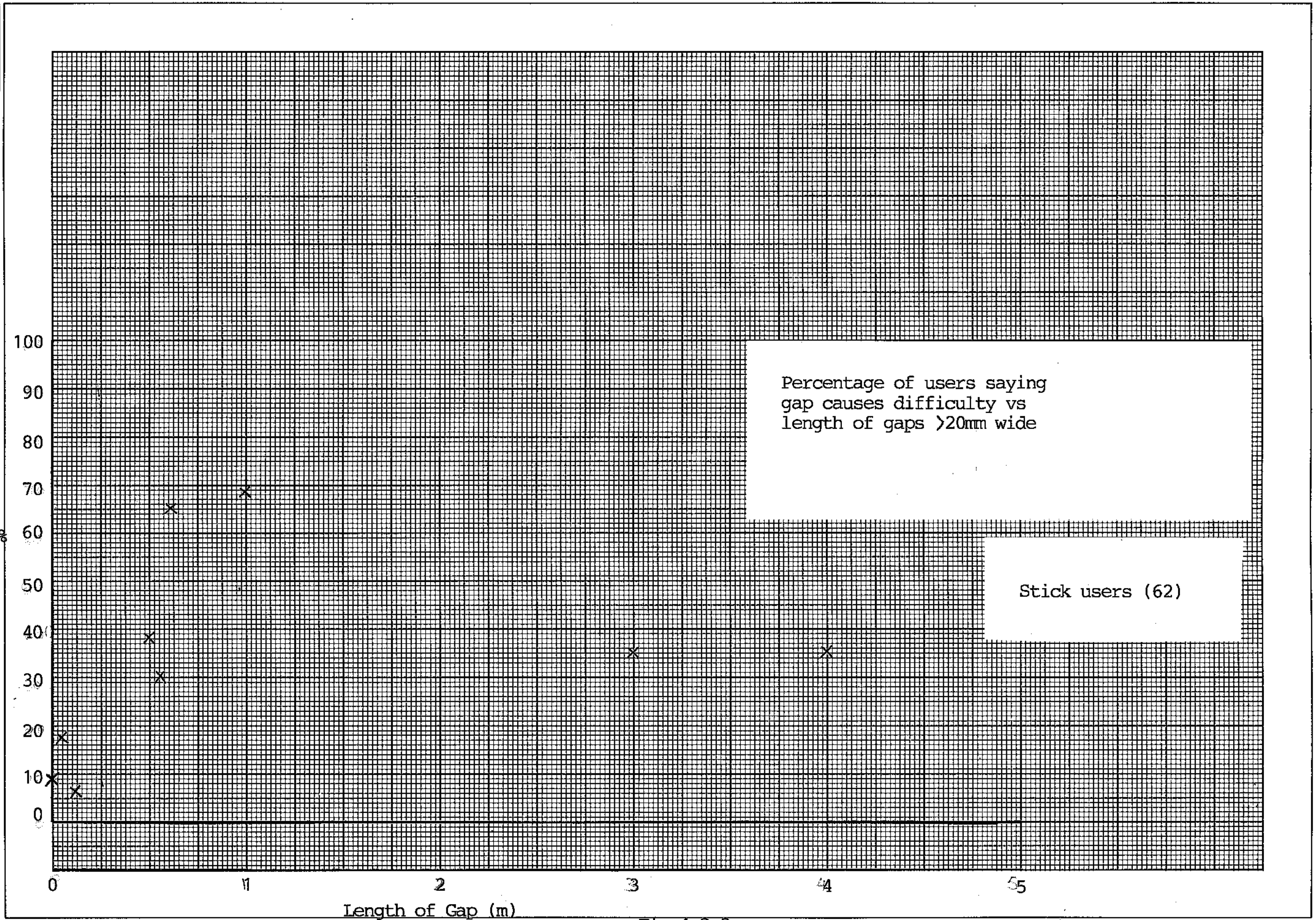

Percentage of participants saying gap causes difficulty vs length of gaps > 20mm wide
Wheelchair users (64)
100
90
80
70
%
60
50
40
30
20
10
0
0
1
2
3
4
5
Length of Gap (m)

Fig 4.2.1



Percentage of users saying
gap causes difficulty vs
length of gaps >20mm wide
Stick users (62)
%
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
Length of Gap (m)

Fig 4.2.2

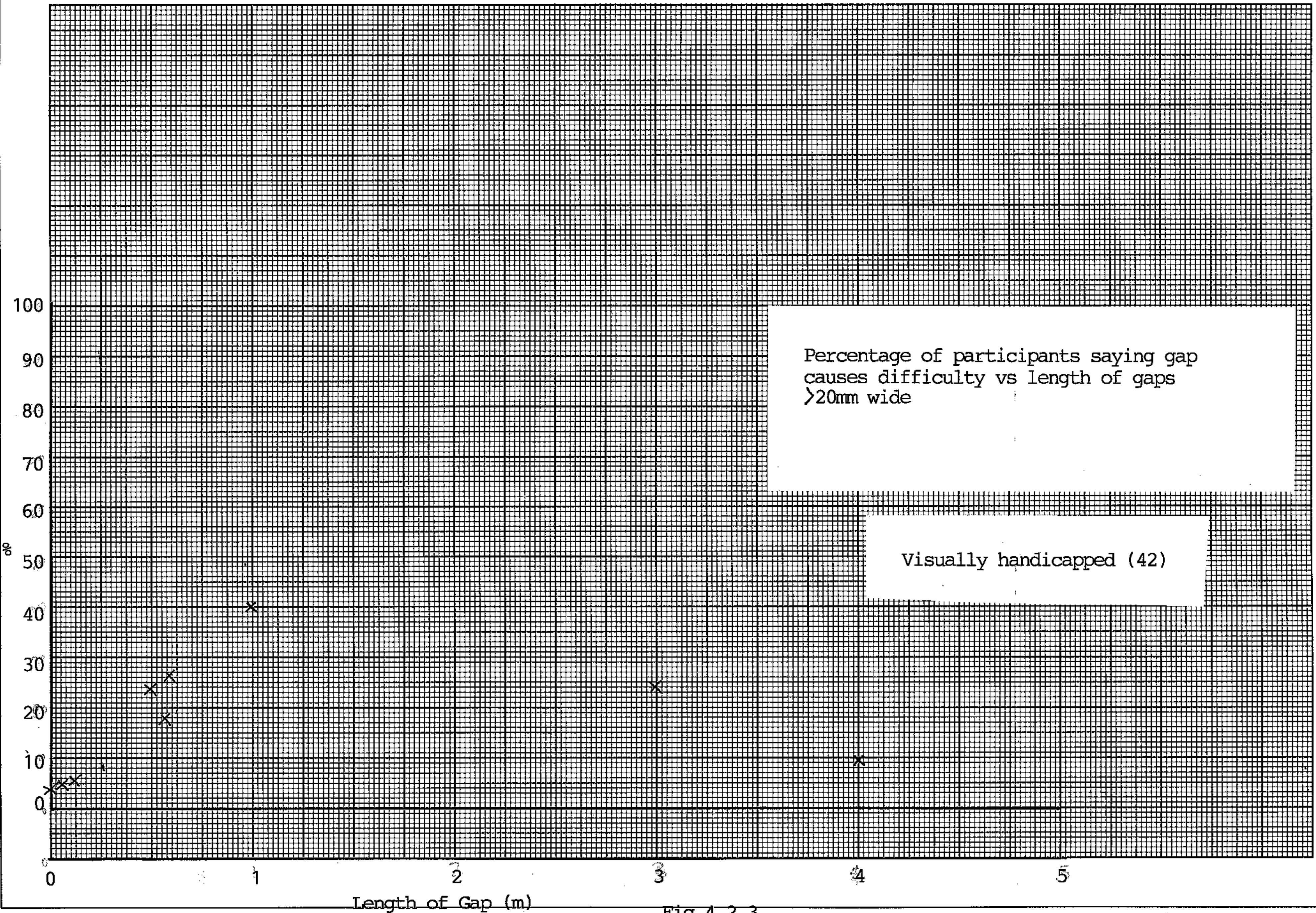

Percentage of participants saying gap causes difficulty vs length of gaps >20mm wide
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
Length of Gap (m)

Fig 4.2.3

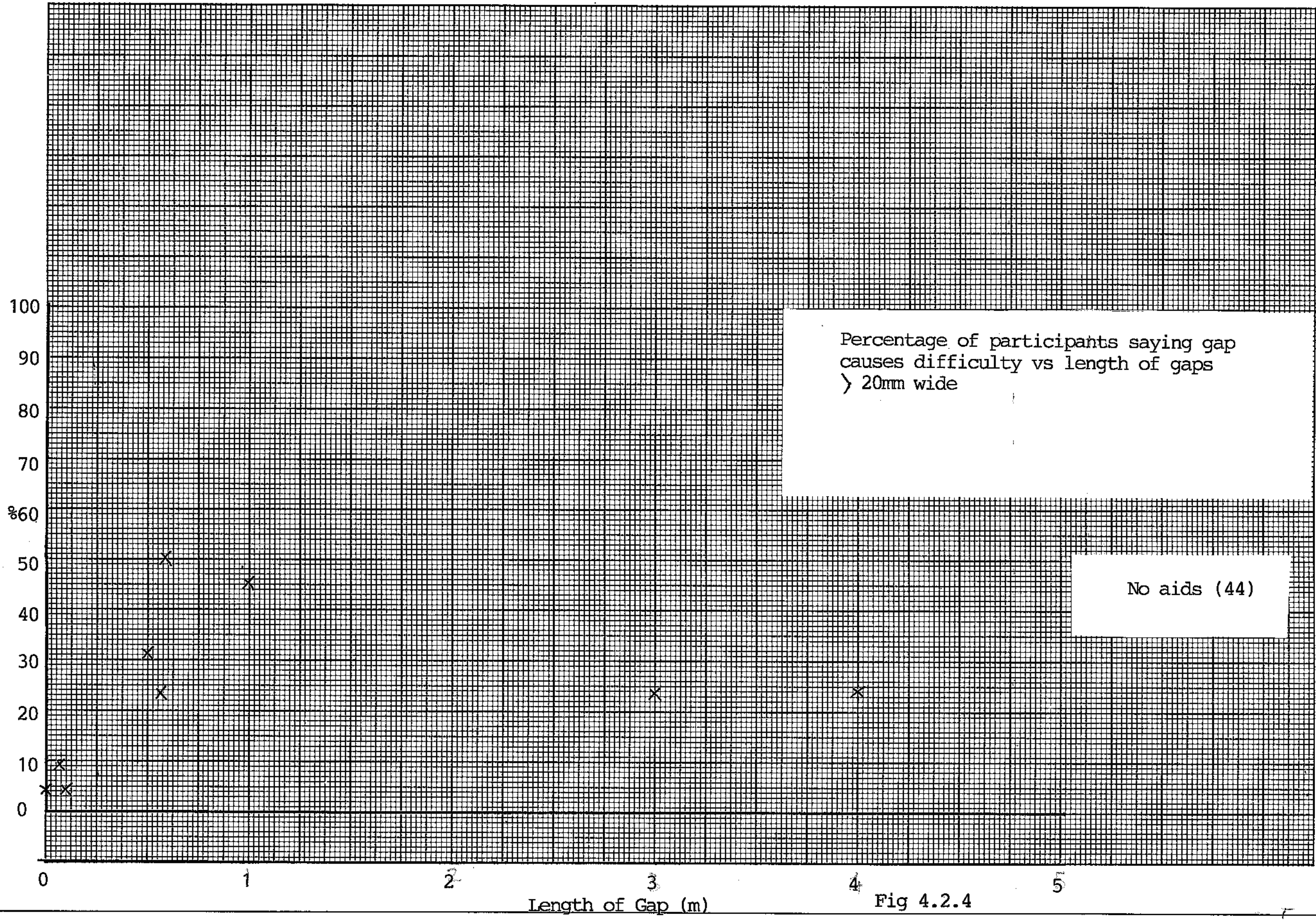

Percentage of participants saying gap causes difficulty vs length of gaps 〉 20mm wide
No aids (44)
%
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
Length of Gap (m)

Fig 4.2.4

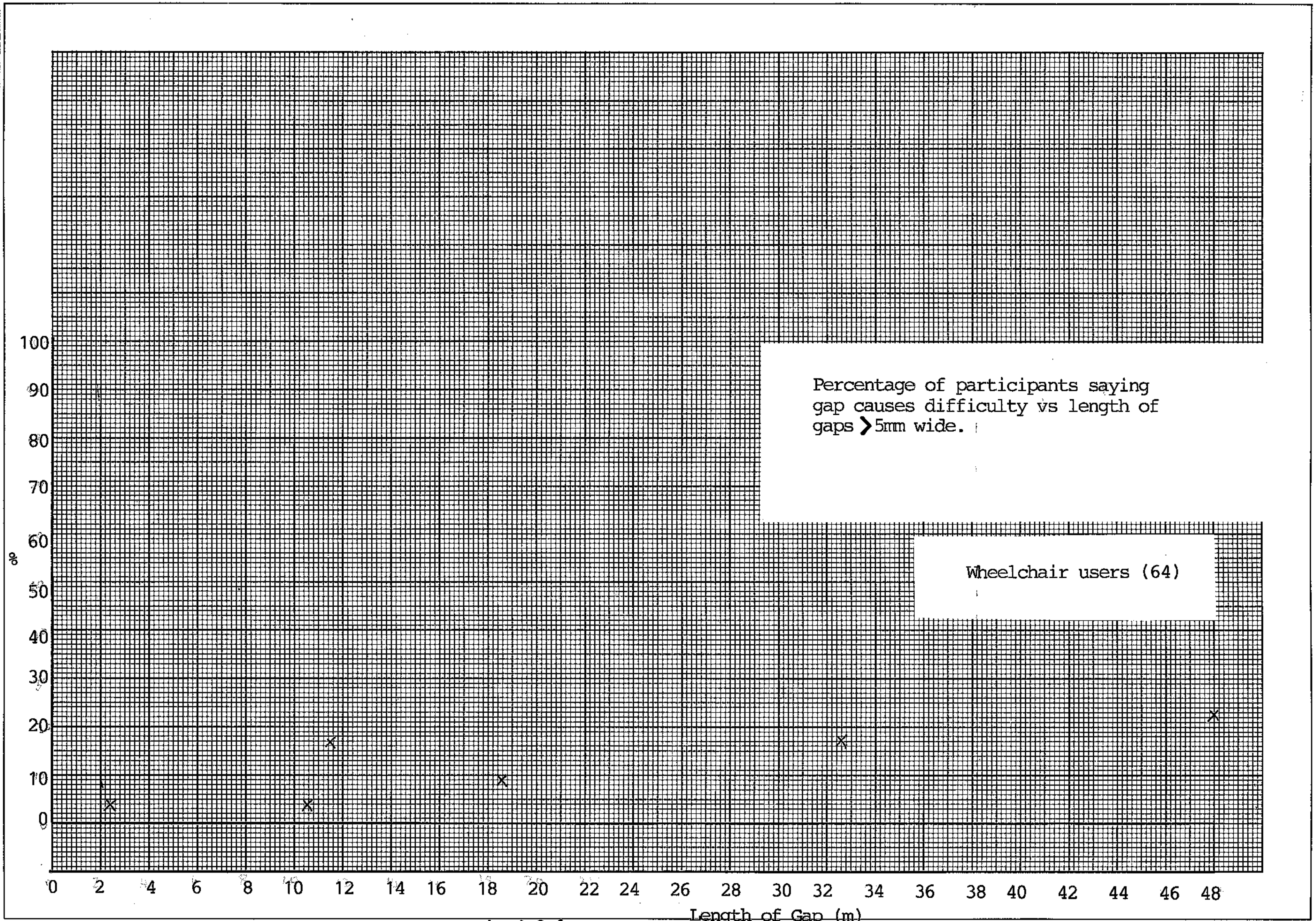
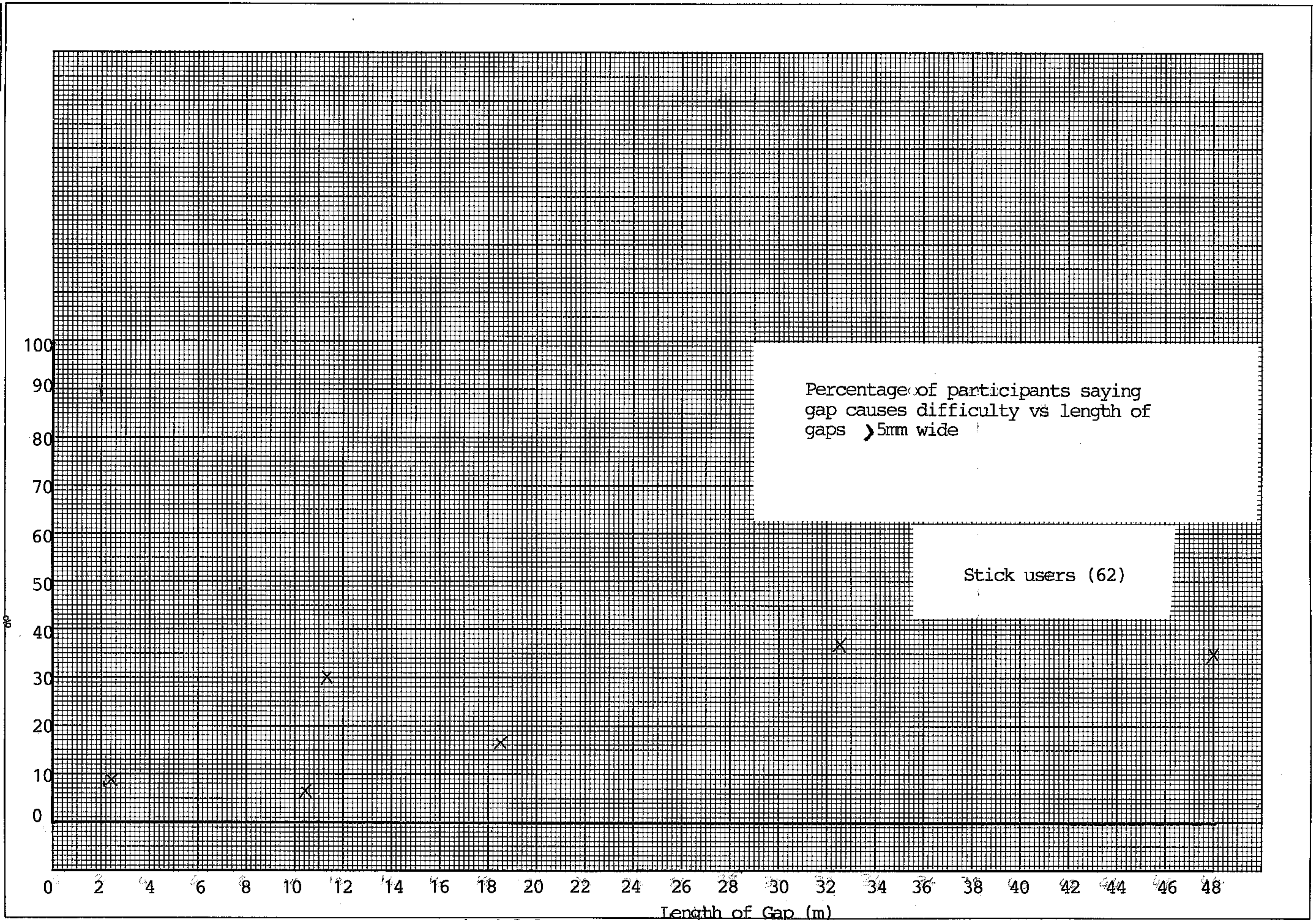
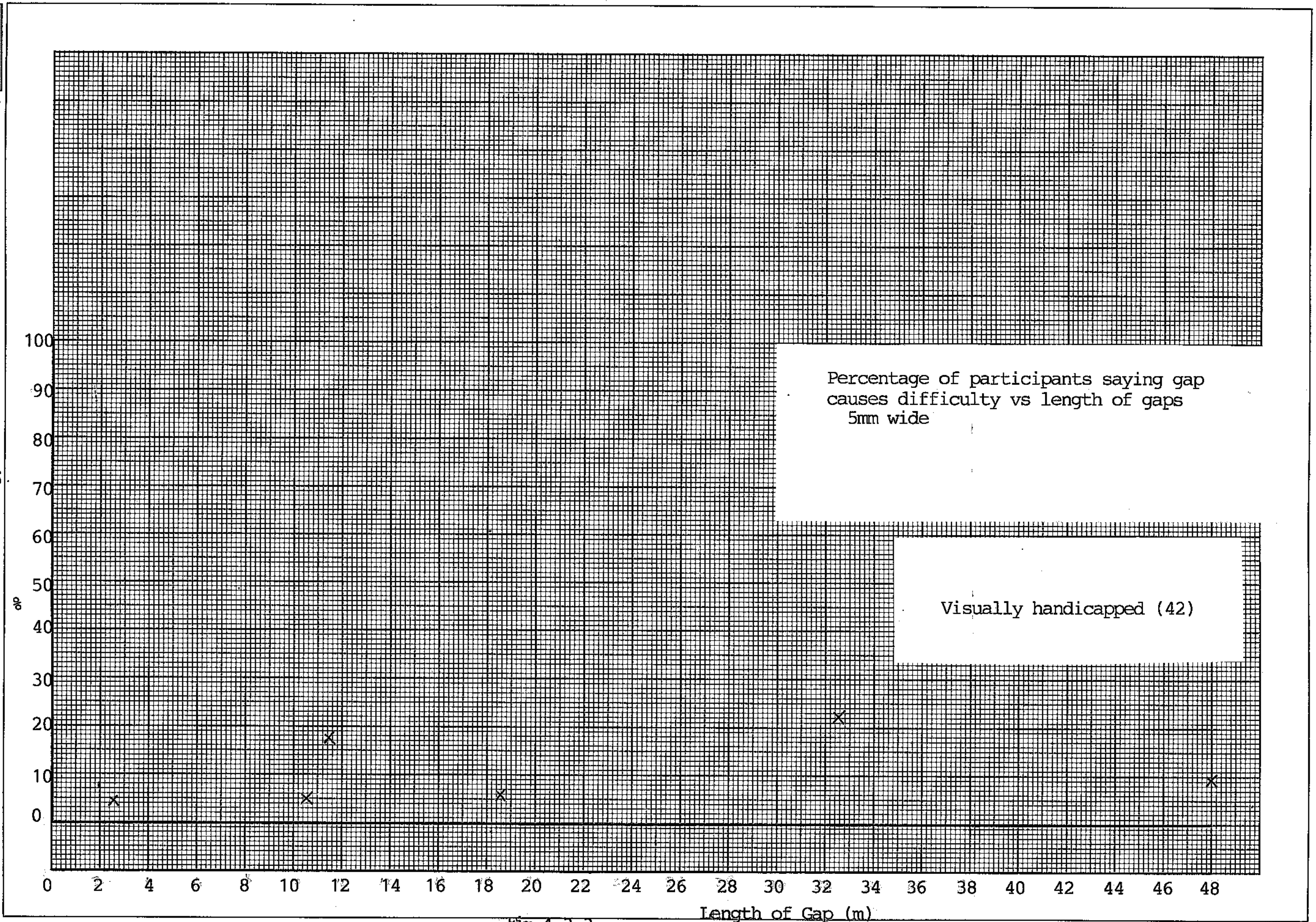

100
90
80
70
60
%
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Length of Gap (m)
Percentage of participants saying gap causes difficulty vs length of gaps > 5mm wide.
Wheelchair users (64)

Fig 4.3.1



Percentage of participants saying gap causes difficulty vs length of gaps >5mm wide
Stick users (62)
%
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Length of Gap (m)

Fig 4.3.2


Percentage of participants saying gap causes difficulty vs length of gaps 5mm wide
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Length of Gap (m)
Fig 4.3.3

42 43

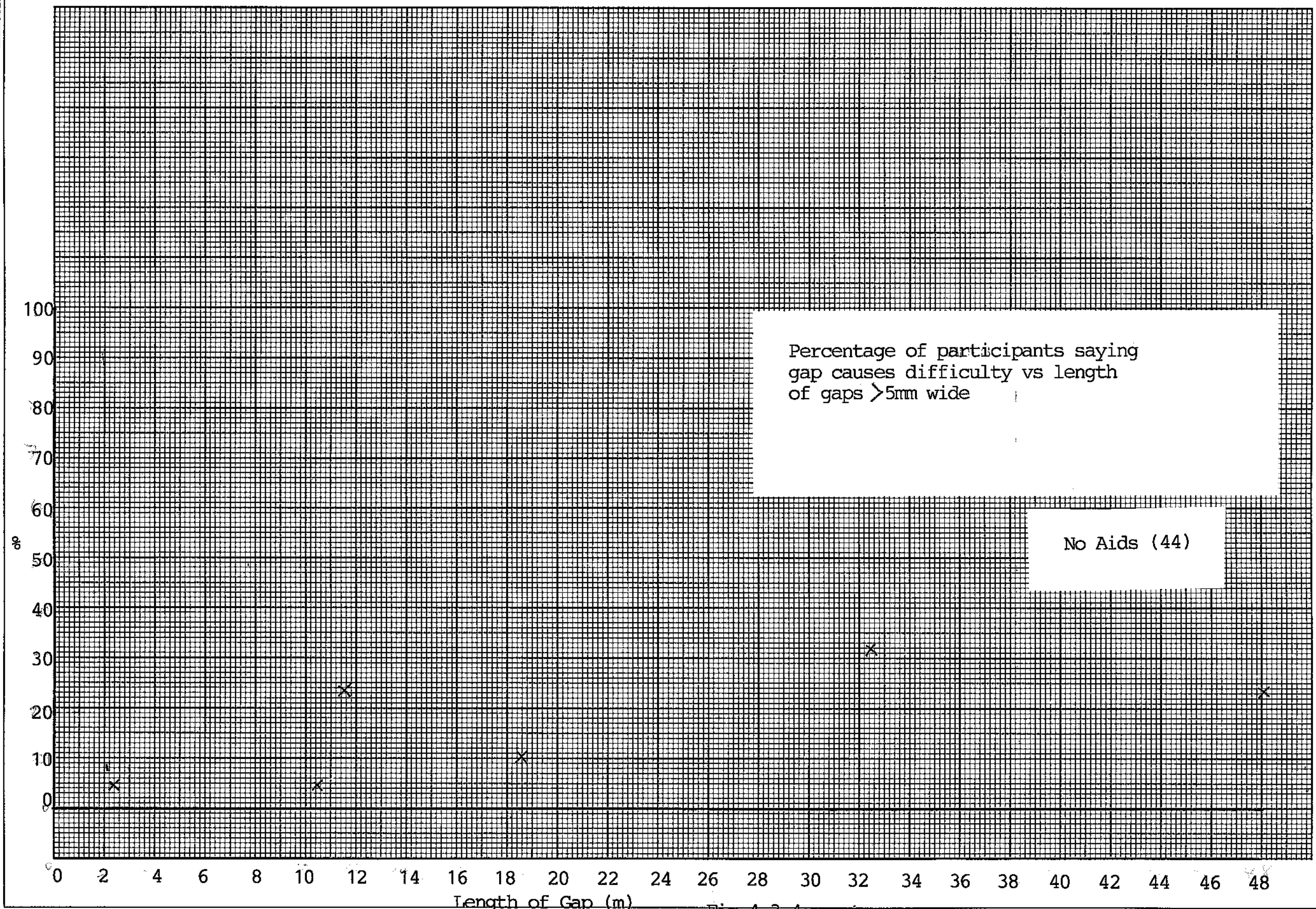

Percentage of participants saying gap causes difficulty vs length of gaps >5mm wide
No Aids (44)
%
0
10
20
30
40
50
60
70
80
90
100
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
Length of Gap (m)

Fig 4.3.4

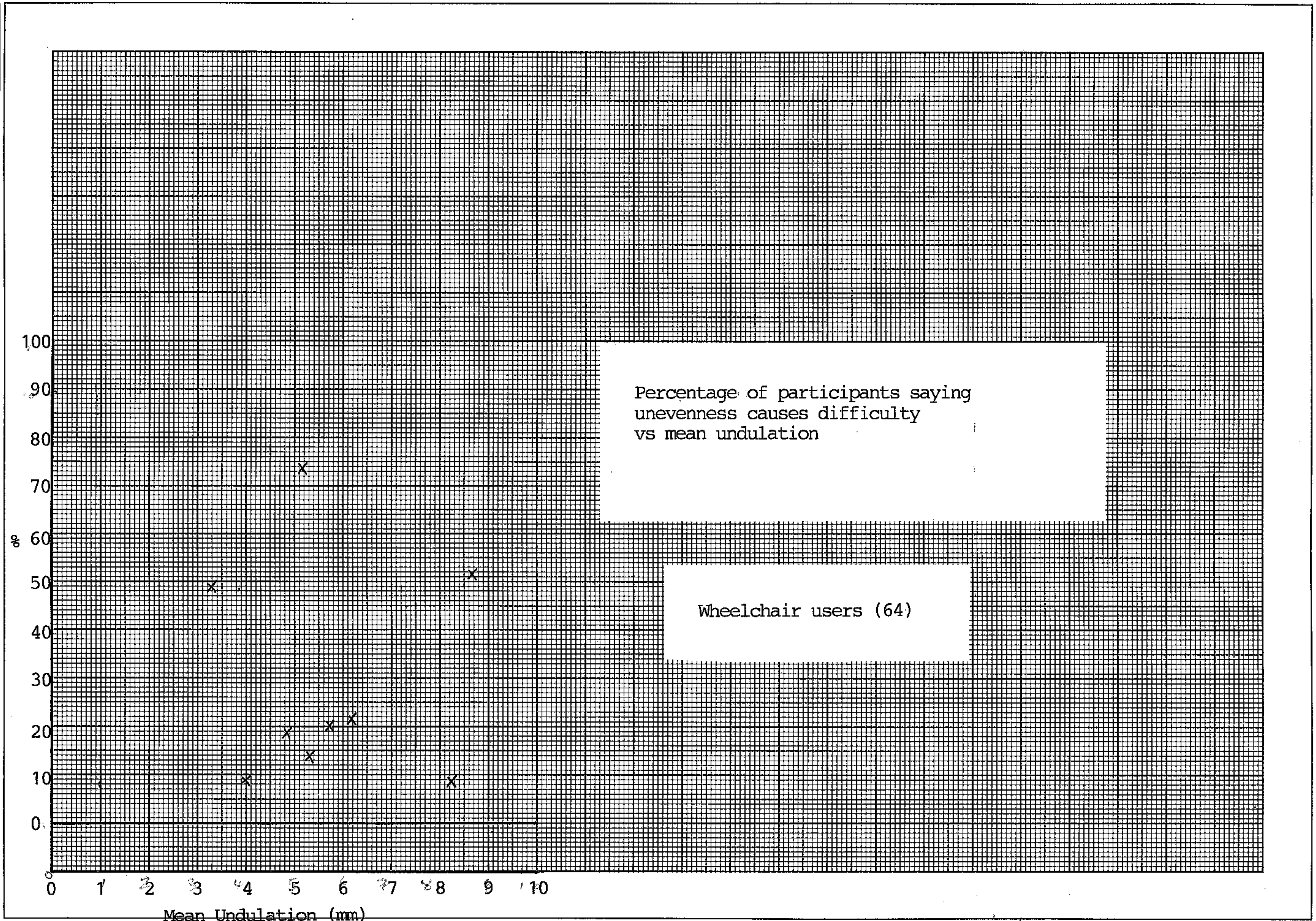

Percentage of participants saying
unevenness causes difficulty
vs mean undulation
Wheelchair users (64)
%
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10
Mean Undulation (mm)

Fig 4.4.1

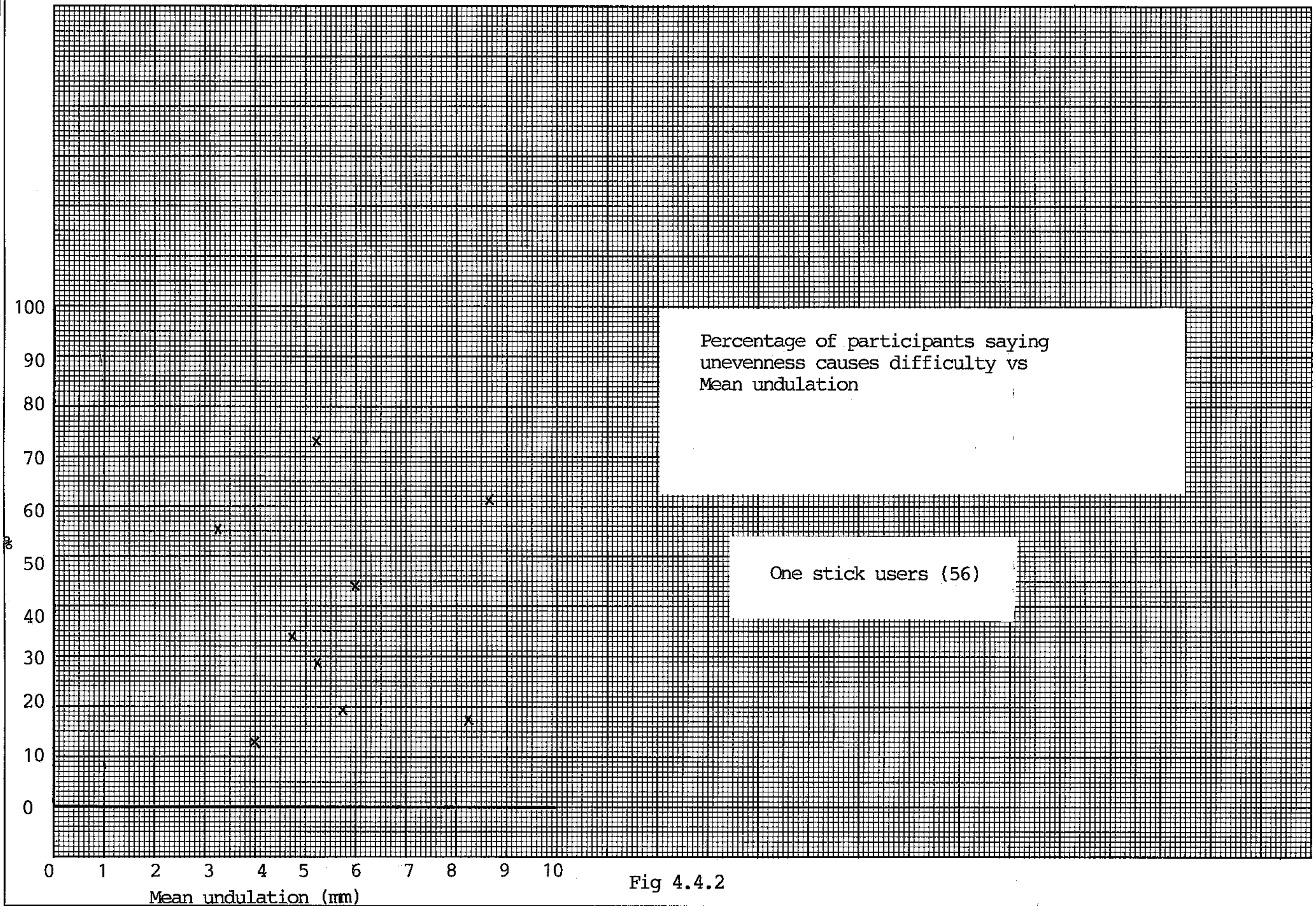

Percentage of participants saying
unevenness causes difficulty vs
Mean undulation
One stick users (56)
100
90
80
70
60
%
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10
Mean undulation (mm)

Fig 4.4.2

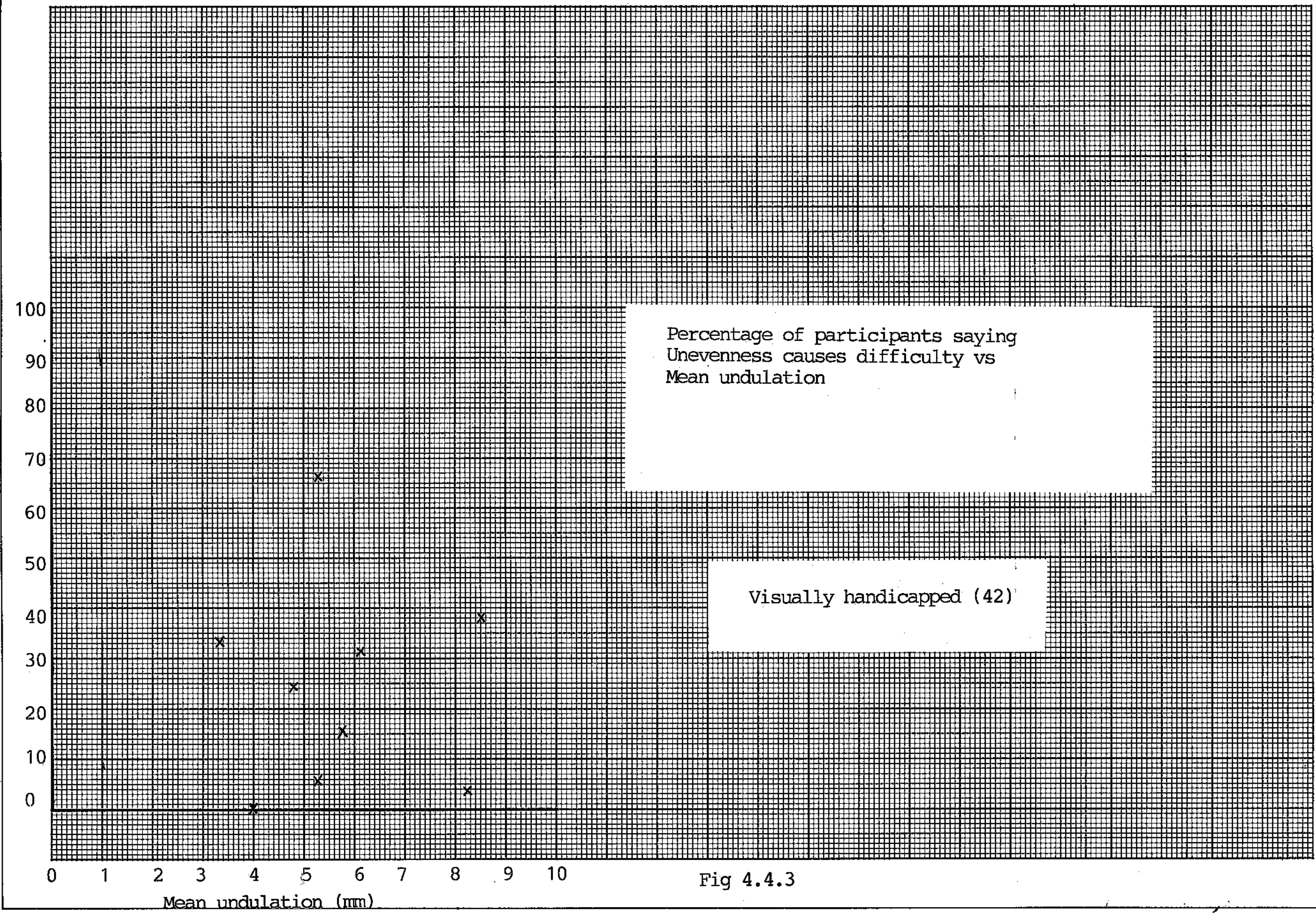

Percentage of participants saying
Unevenness causes difficulty vs
Mean undulation
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10
Mean undulation (mm)

Fig 4.4.3

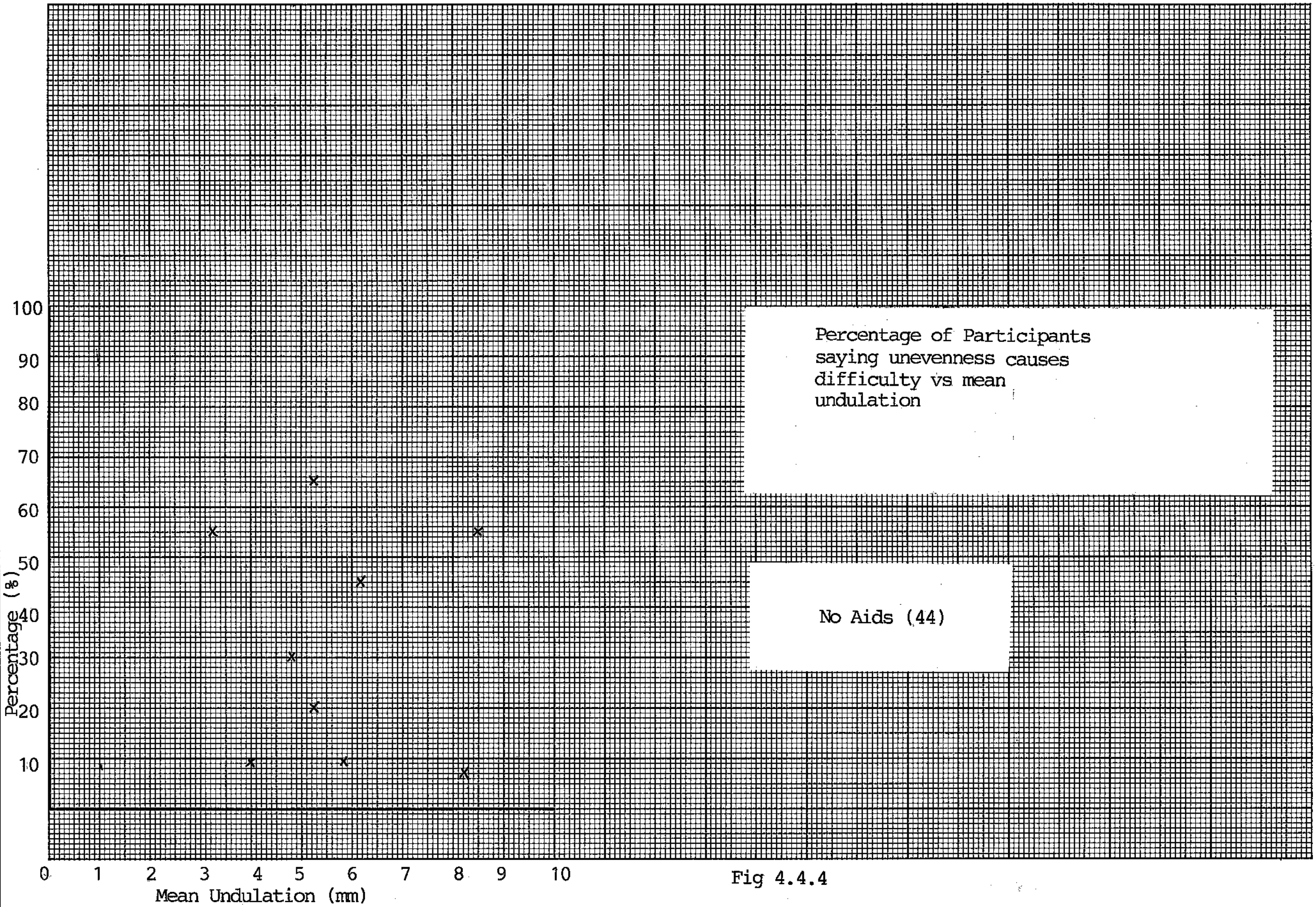

Percentage of Participants
saying unevenness causes
difficulty vs mean
undulation
No Aids (44)
Percentage (%)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
Mean Undulation (mm)

Fig 4.4.4

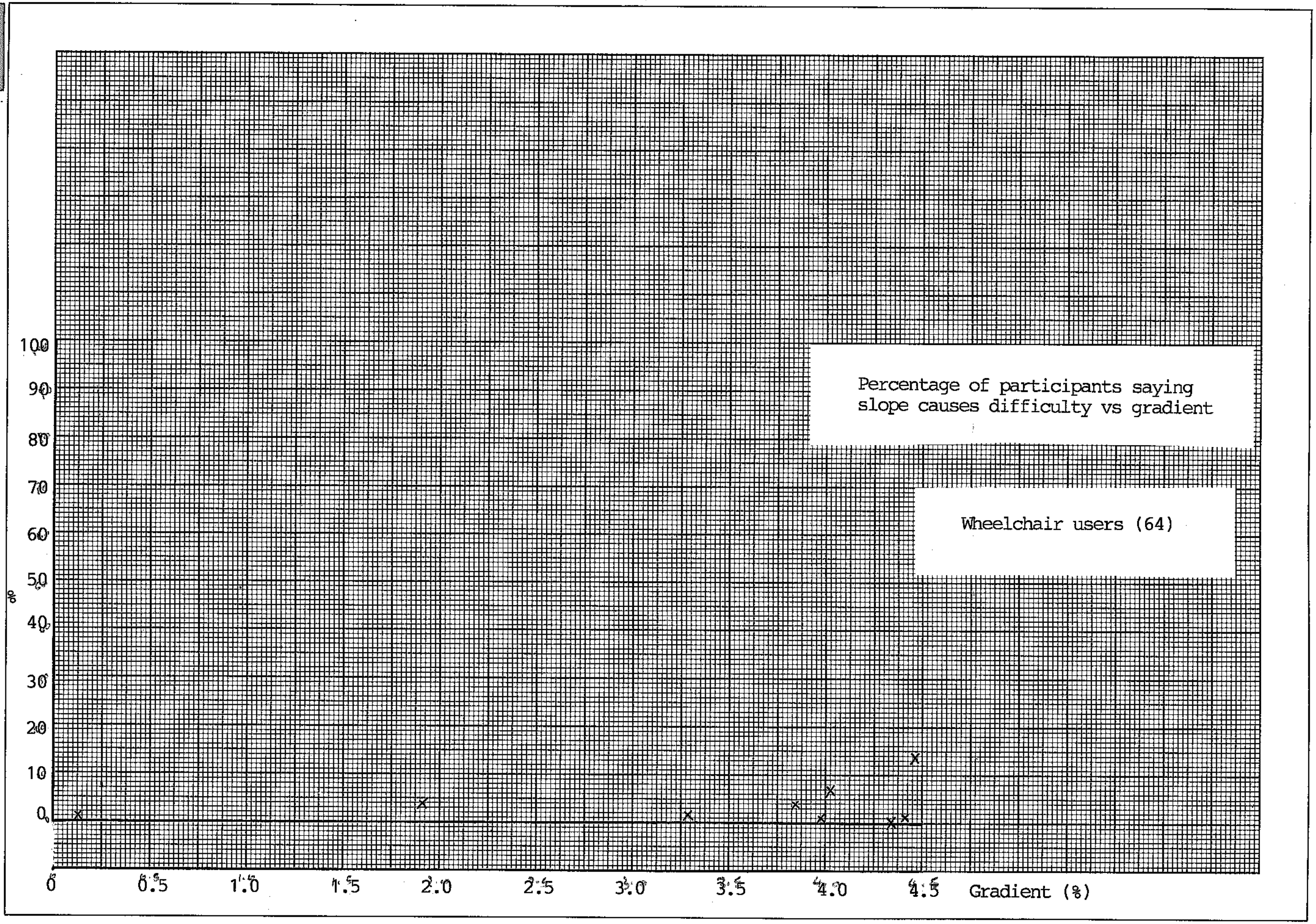

100
90
80
70
60
50
%
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Gradient (%)
Percentage of participants saying slope causes difficulty vs gradient
Wheelchair users (64)

Fig 4.5.1

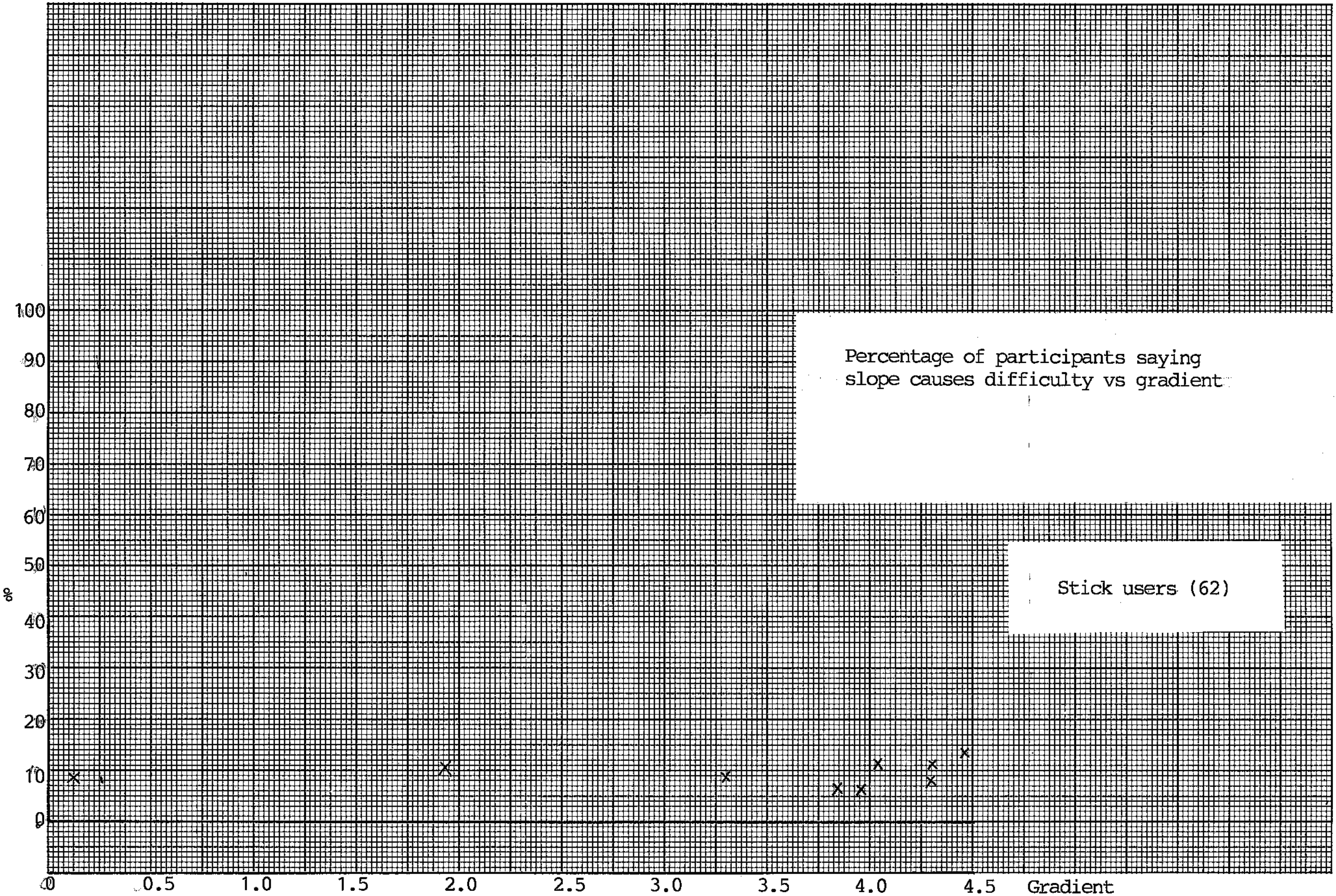

Percentage of participants saying slope causes difficulty vs gradient
Stick users (62)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Gradient

Fig 4.5.2

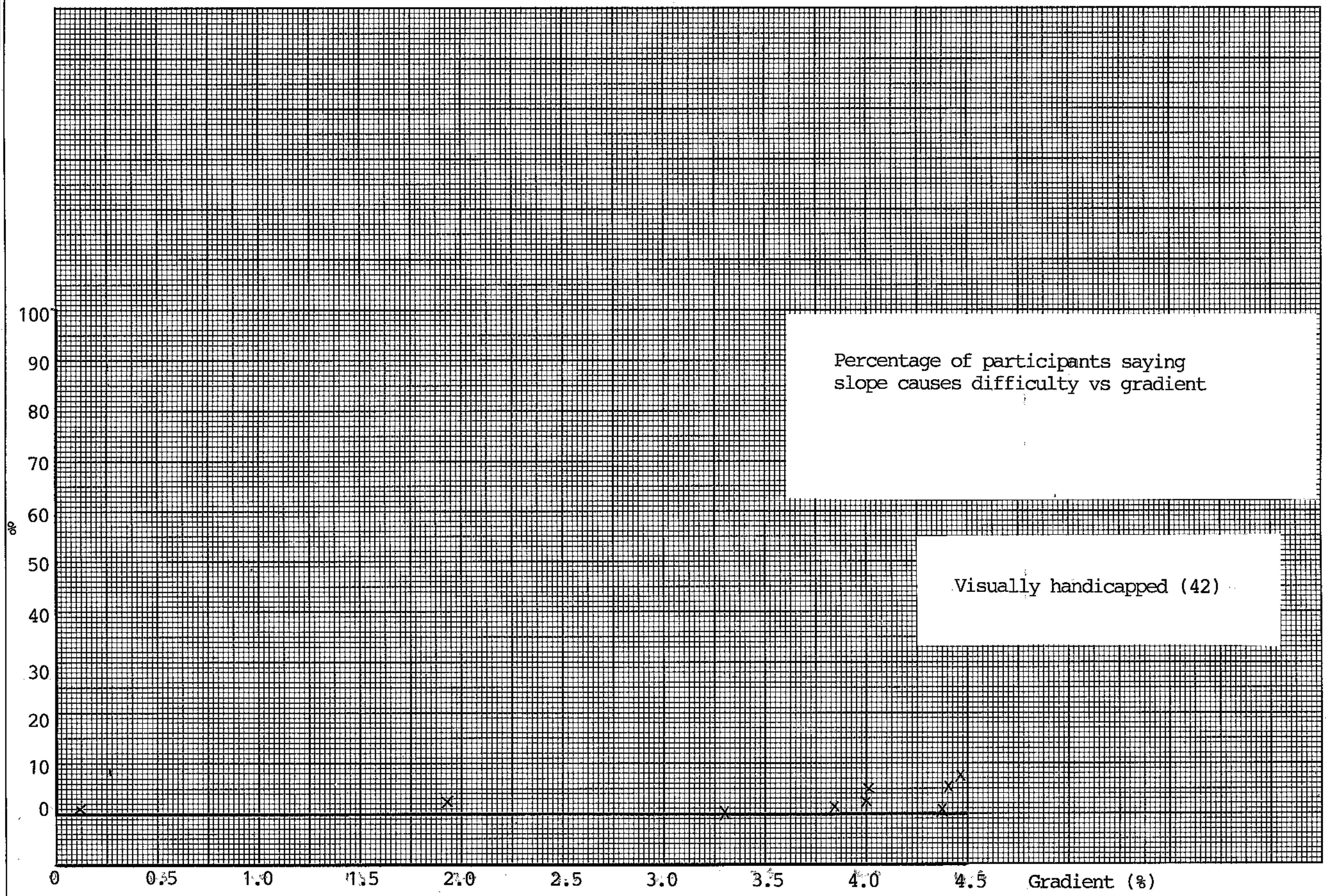
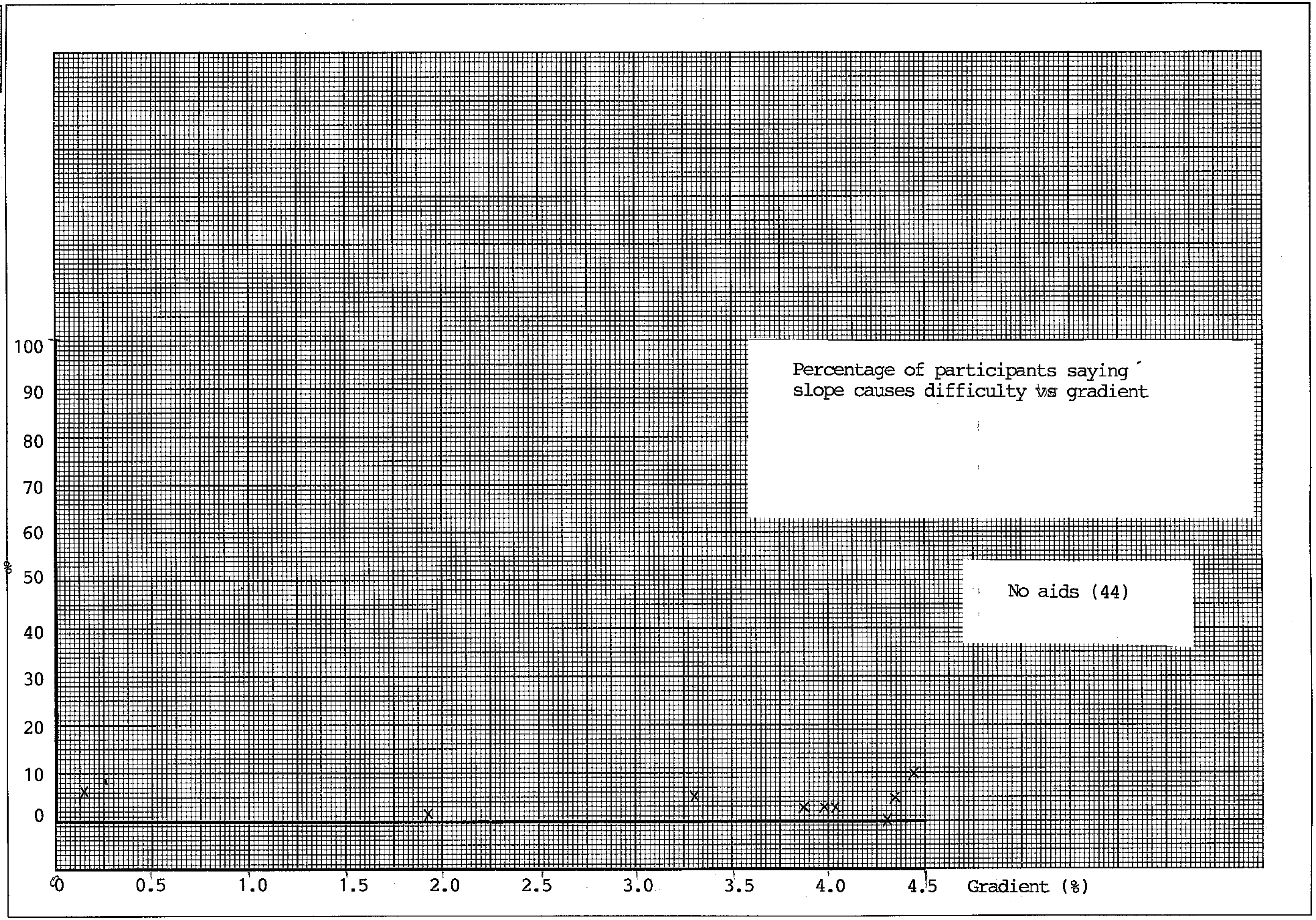

Percentage of participants saying slope causes difficulty vs gradient
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Gradient (%)

Fig 4..5.3



Percentage of participants saying slope causes difficulty vs gradient
No aids (44)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Gradient (%)

Fig 4.5.4

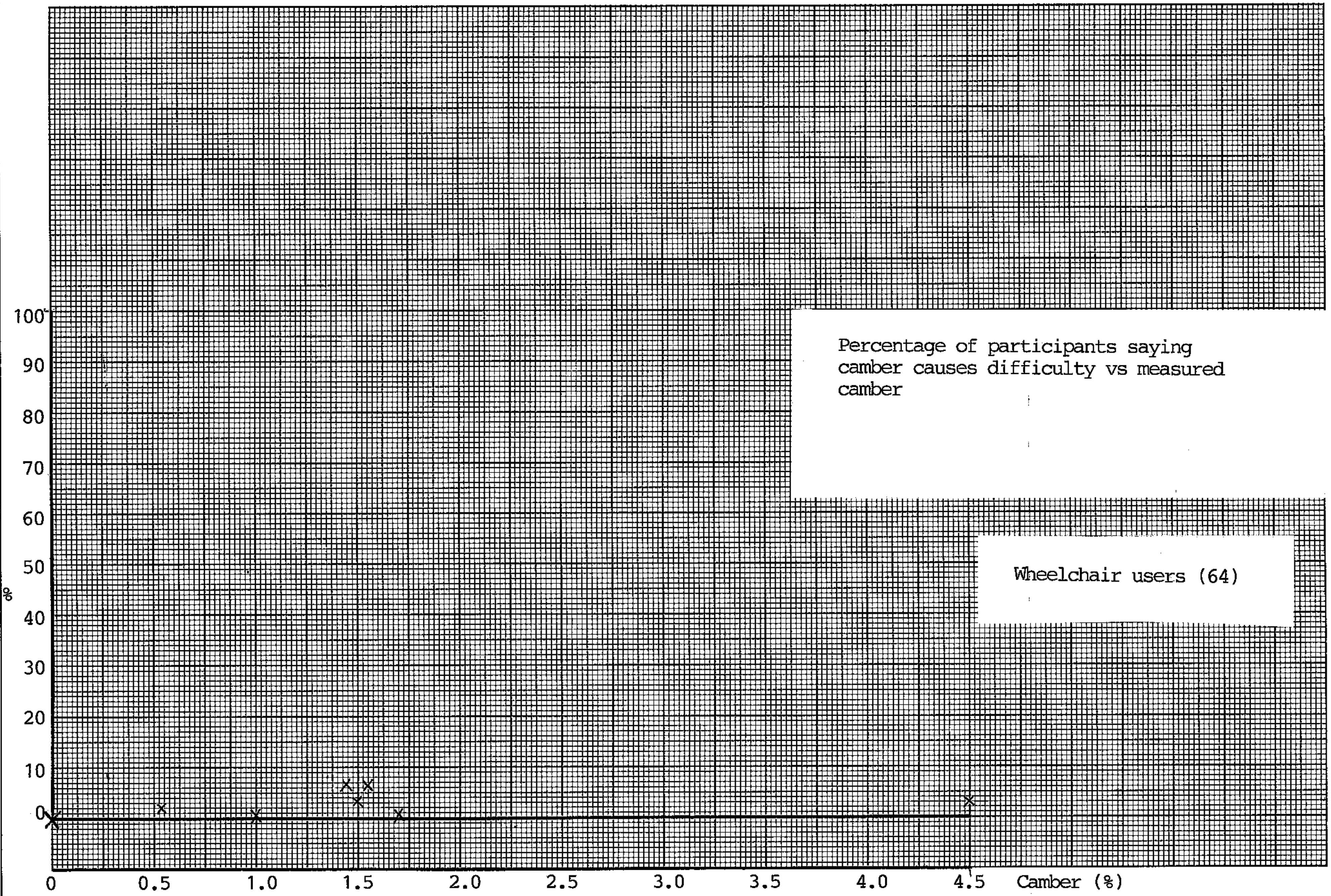

Percentage of participants saying camber causes difficulty vs measured camber
Wheelchair users (64)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Camber (%)

Fig 4.6.1

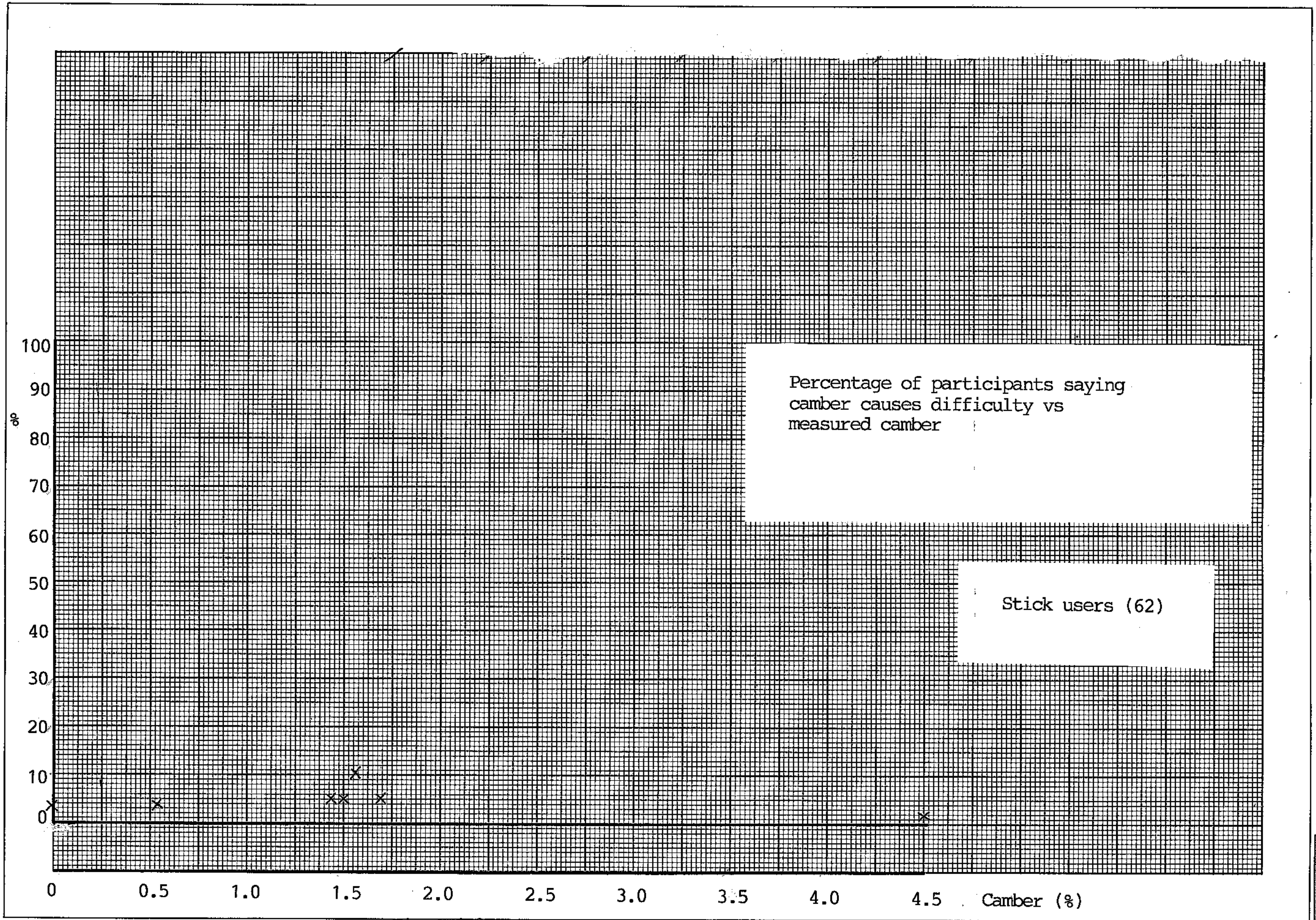

Percentage of participants saying camber causes difficulty vs measured camber
Stick users (62)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Camber (%)

Fig 4.6.2

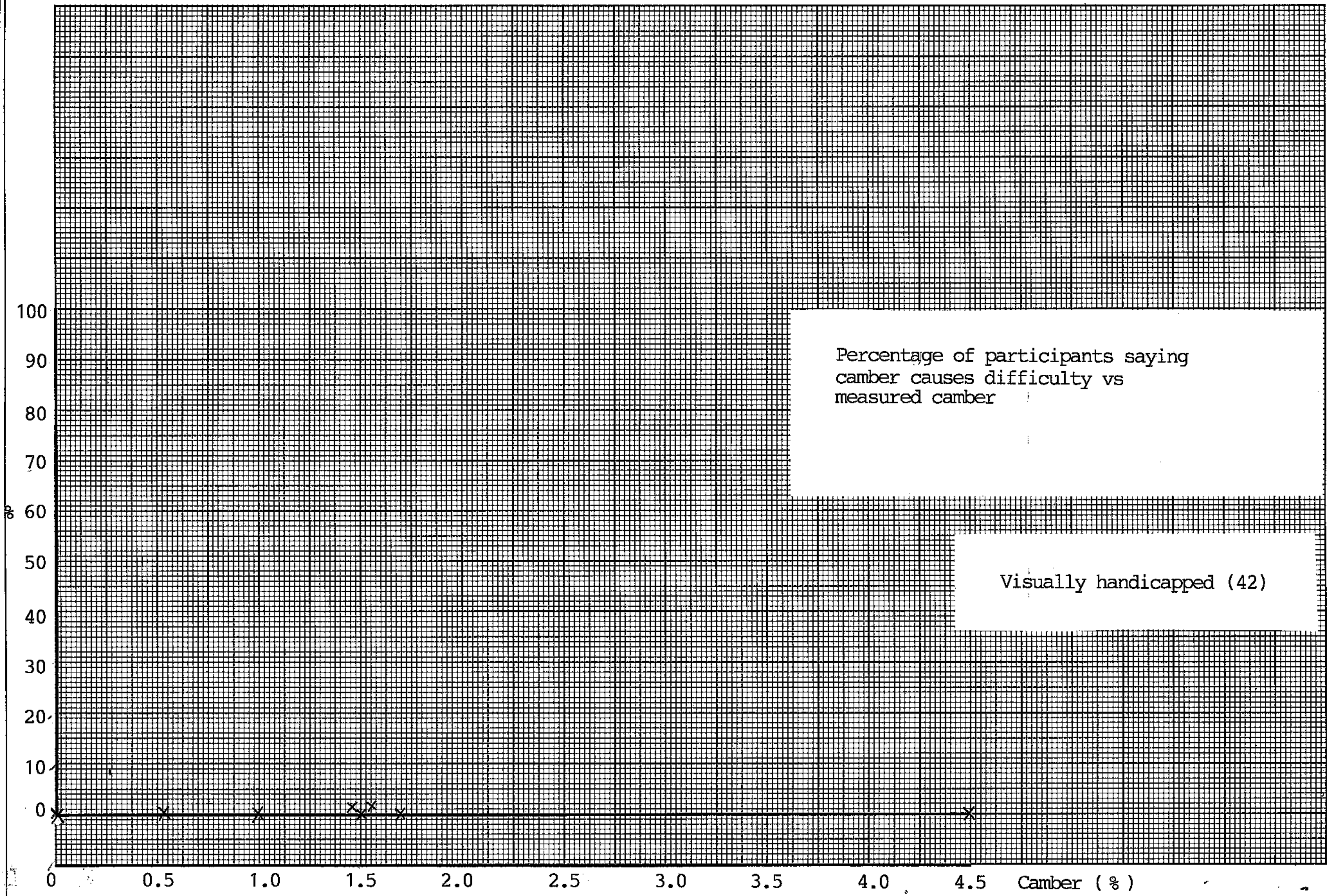
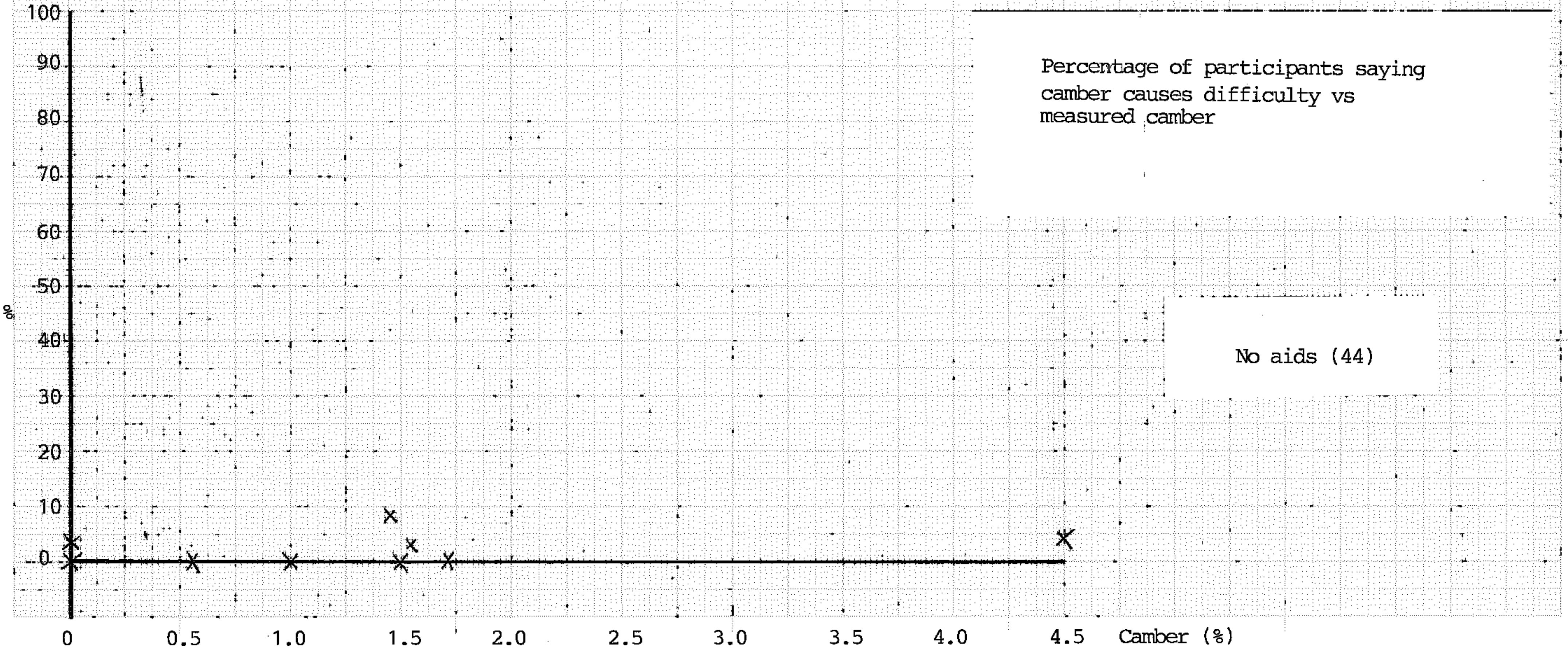

Percentage of participants saying
camber causes difficulty vs
measured camber
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Camber (%)

Fig 4.6.3



Percentage of participants saying camber causes difficulty vs measured camber
No aids (44)
%
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Camber (%)

Fig 4.6.4

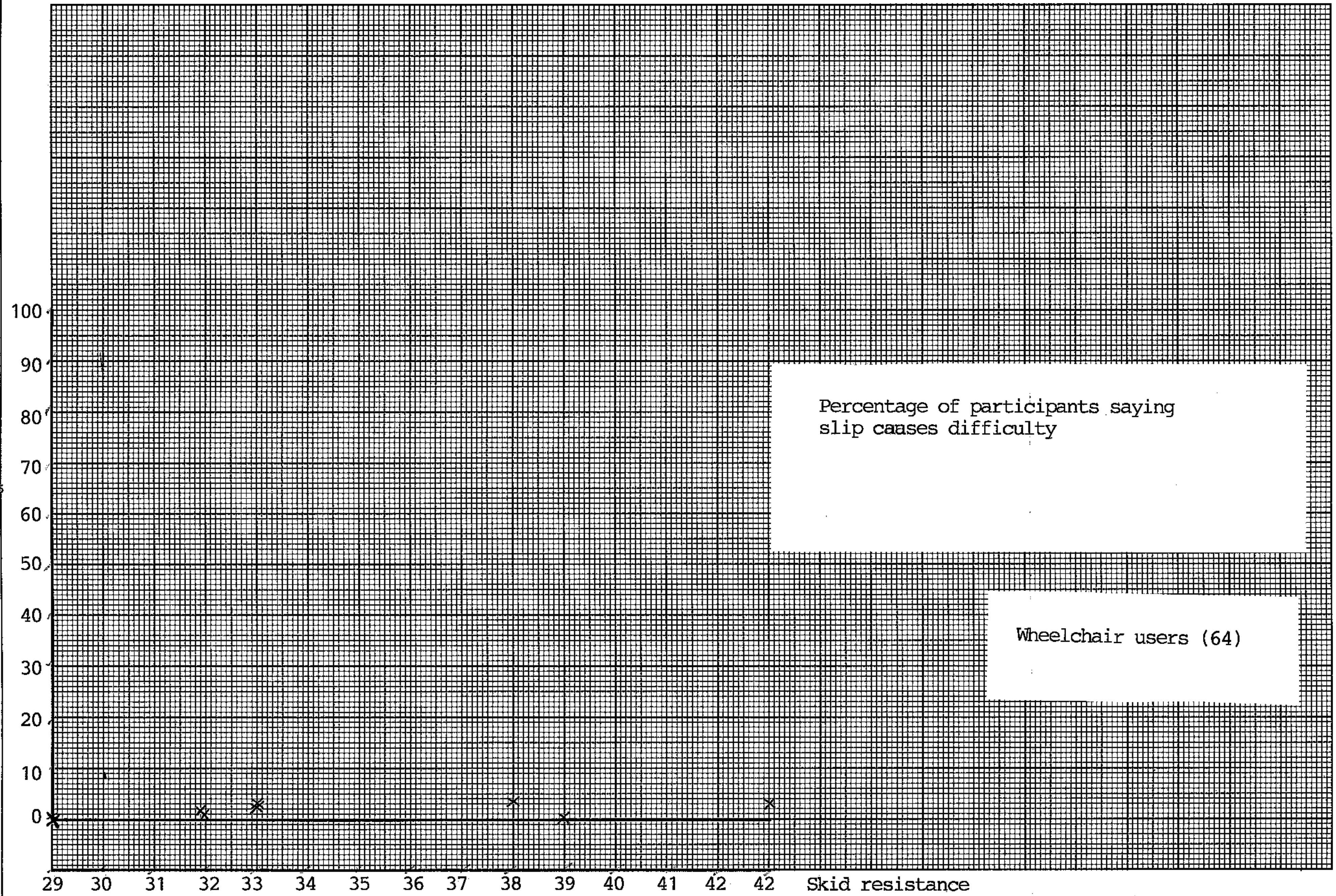

100
90
80
70
60
50
40
30
20
10
0
%
29
30
31
32
33
34
35
36
37
38
39
40
41
42
42
Skid resistance
Percentage of participants saying
slip caases difficulty
Wheelchair users (64)

Fig 4.7.1

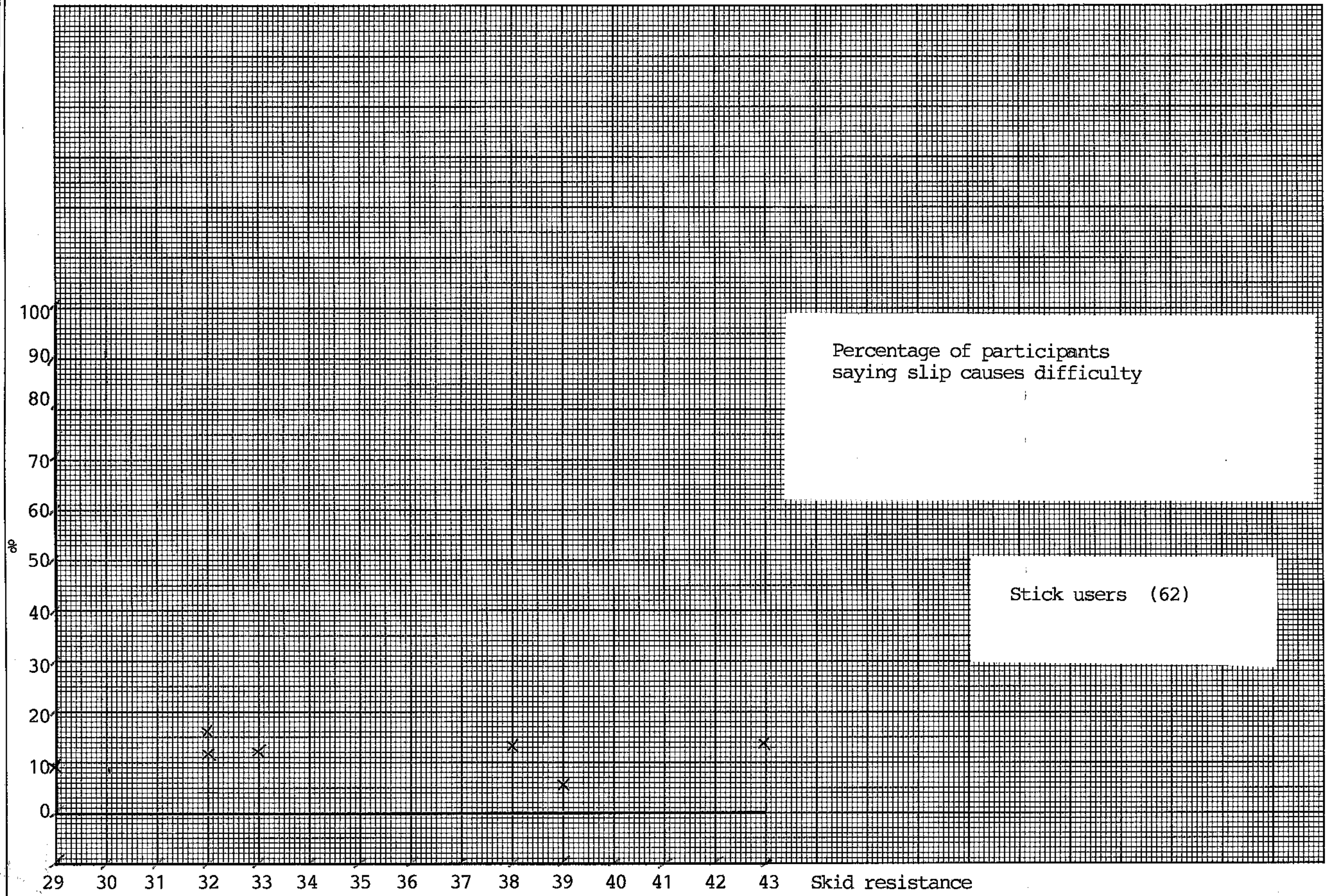

Percentage of participants
saying slip causes difficulty
Stick users (62)
%
100
90
80
70
60
50
40
30
20
10
0
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
Skid resistance

Fig 4.7.2

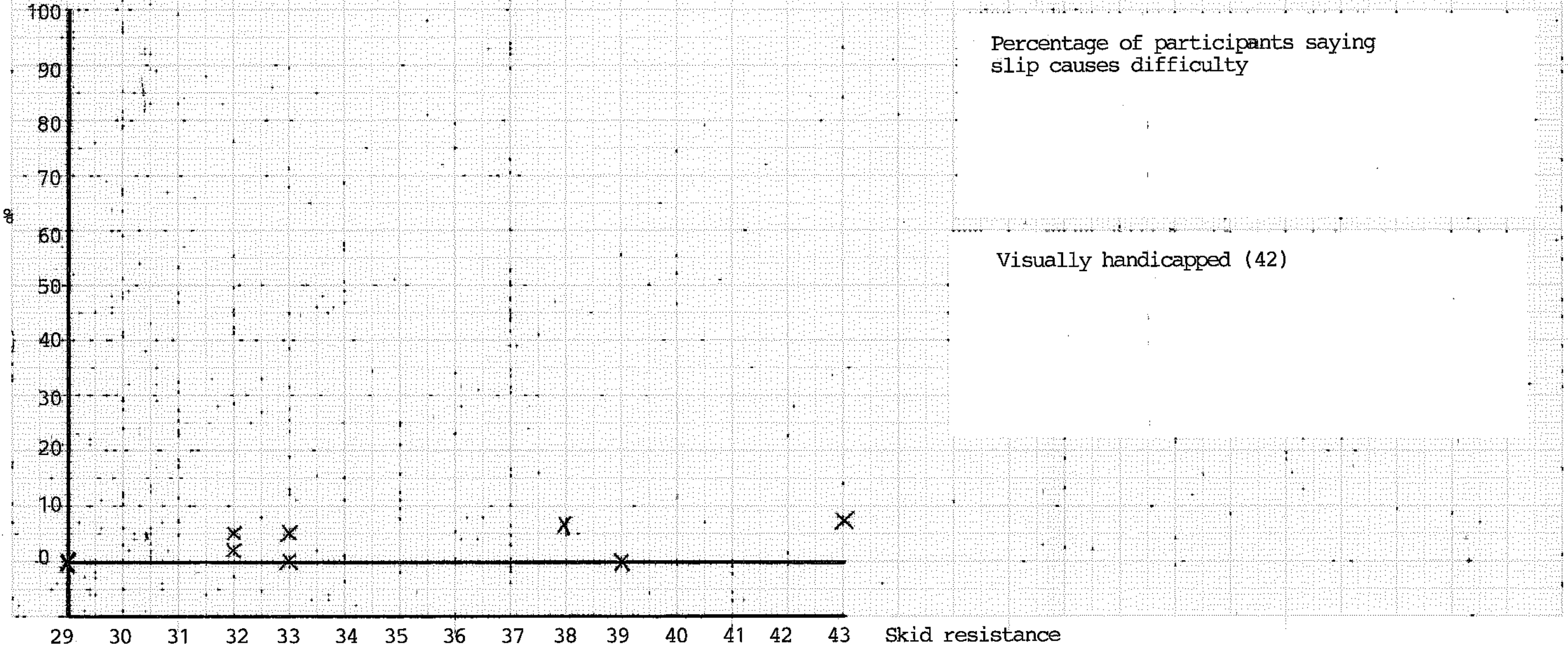

Percentage of participants saying slip causes difficulty
Visually handicapped (42)
%
100
90
80
70
60
50
40
30
20
10
0
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
Skid resistance

Fig 4.7.3

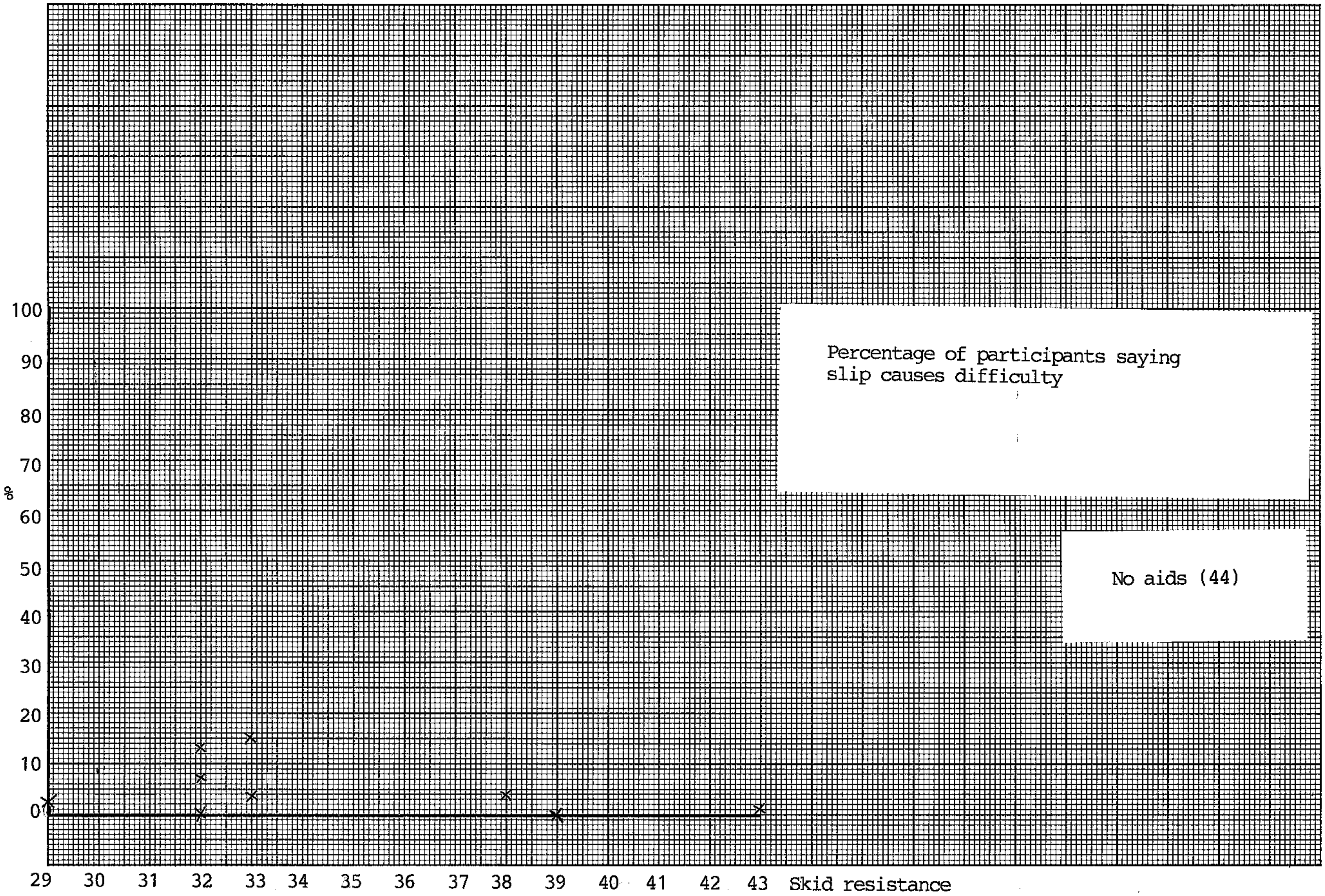
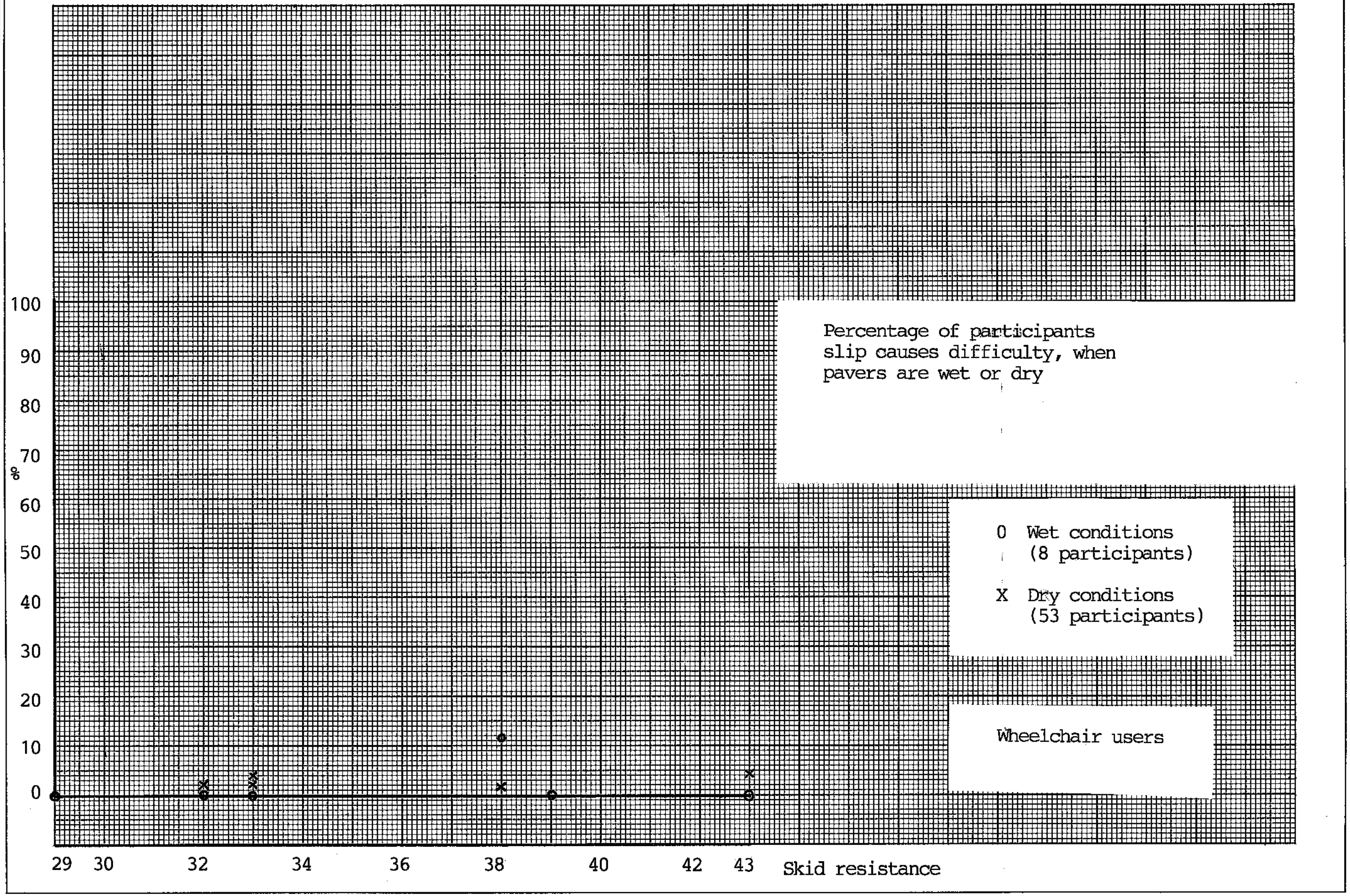

Percentage of participants saying
slip causes difficulty
No aids (44)
%
100
90
80
70
60
50
40
30
20
10
0
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
Skid resistance

Fig 4.7.4



Percentage of participants slip causes difficulty, when pavers are wet or dry
0 Wet conditions (8 participants)
X Dry conditions (53 participants)
Wheelchair users
%
100
90
80
70
60
50
40
30
20
10
0
29
30
32
34
36
38
40
42
43
Skid resistance

Fig 4.8.1

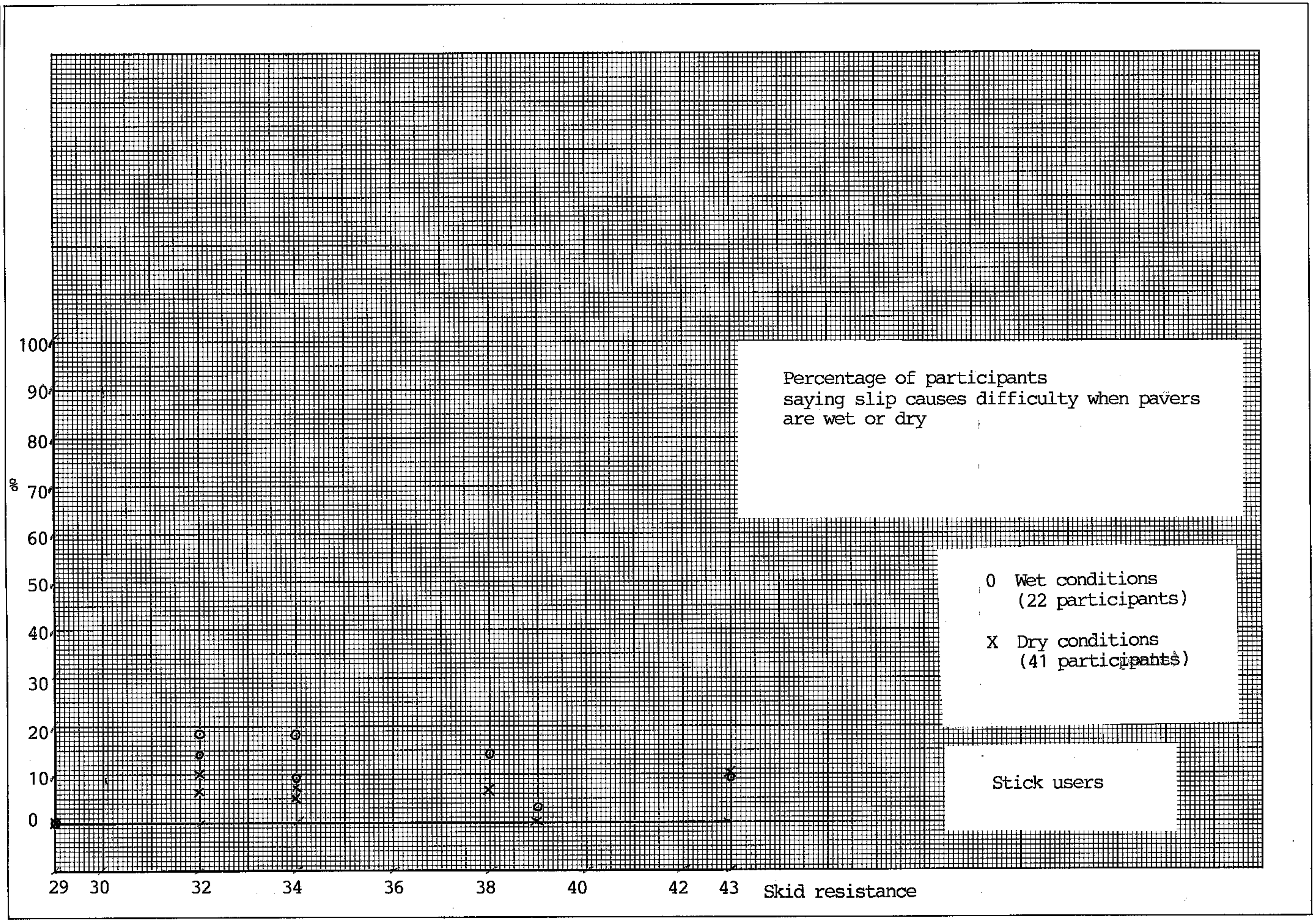
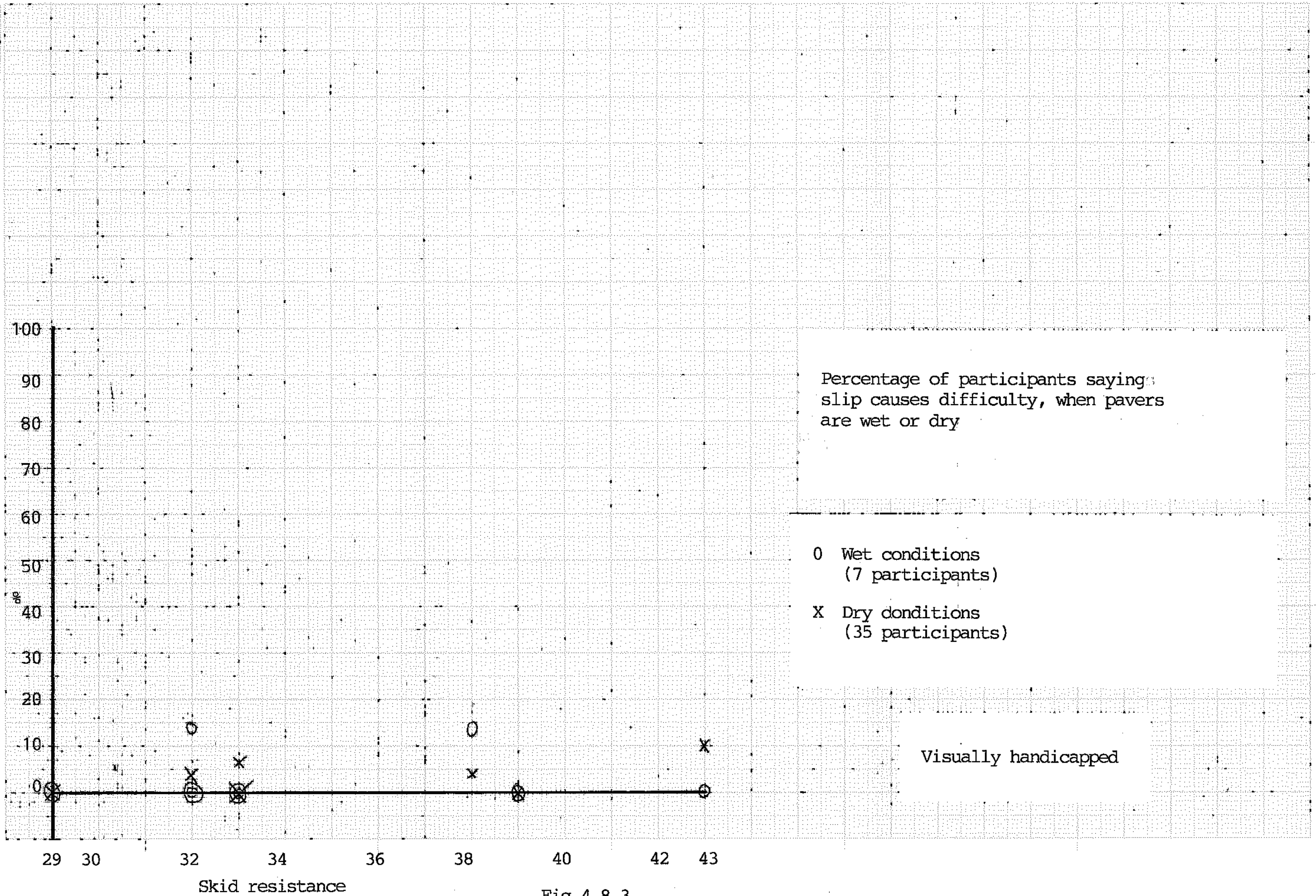

Percentage of participants saying slip causes difficulty when pavers are wet or dry
0 Wet conditions (22 participants)
X Dry conditions (41 participants)
Stick users
%
100
90
80
70
60
50
40
30
20
10
0
29
30
32
34
36
38
40
42
43
Skid resistance

Fig 4.8.2



100
90
80
70
60
50
%
40
30
20
10
0
29
30
32
34
36
38
40
42
43
Skid resistance
Percentage of participants saying
slip causes difficulty, when pavers
are wet or dry
0 Wet conditions
(7 participants)
X Dry donditions
(35 participants)
Visually handicapped

Fig 4.8.3

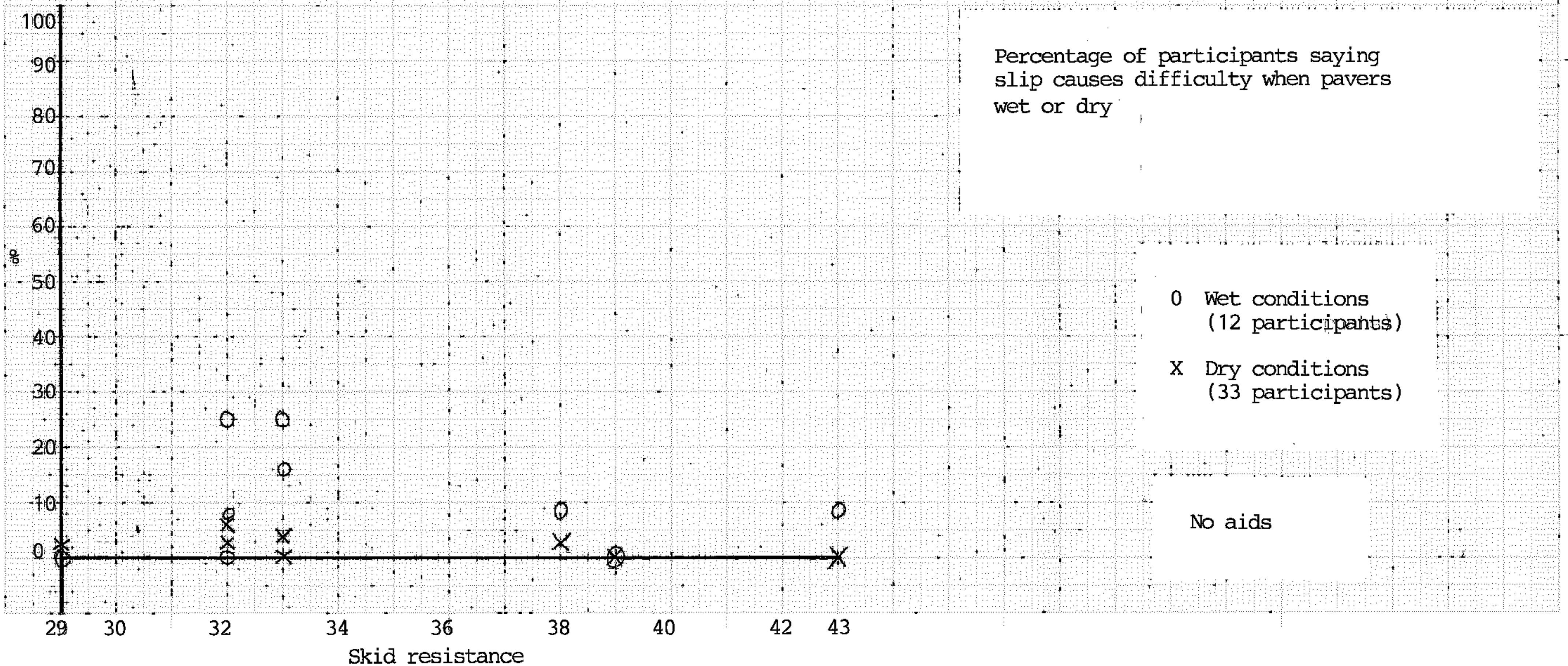

Percentage of participants saying slip causes difficulty when pavers wet or dry
0 Wet conditions (12 participants)
X Dry conditions (33 participants)
No aids
%
100
90
80
70
60
50
40
30
20
10
0
29
30
32
34
36
38
40
42
43
Skid resistance

Fig 4.8.4

General Assessment of risk of stumbling and difficulty in moving over marked area

Key: Risk
5 A severe risk
3 A slight risk
1 No significant risk

Severity
5 Impossible
4 Very difficult
3 Difficult
2 Some difficulty
1 No difficulty

Disability Group
A Wheelchair users
B Stick users
C Visually handicapped
D No aids

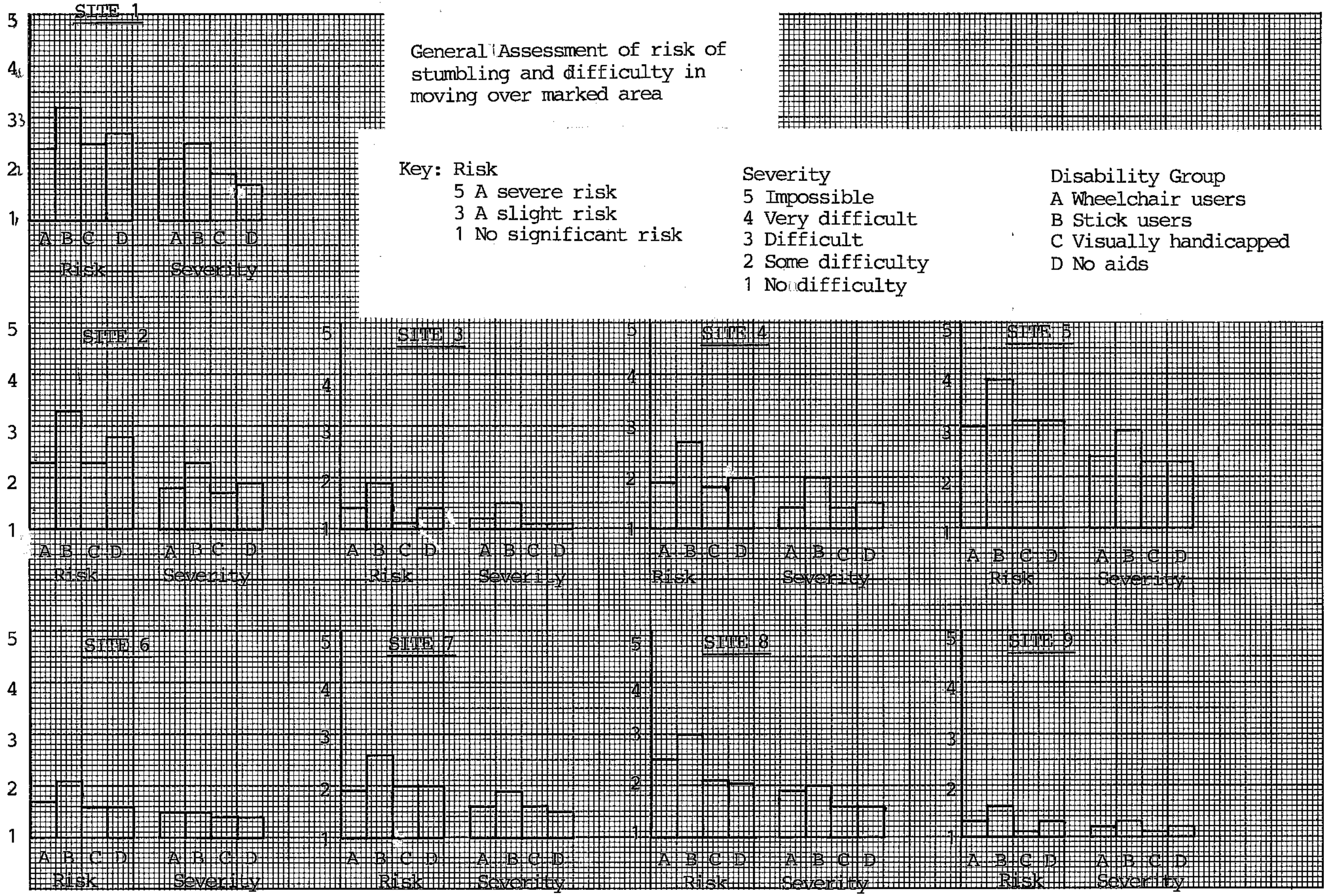


Fig 4.9

5. BUS SHELTER SEATING

5.1 Participants were shown, and invited to try out three types of bus shelter seat: a narrow 'perch' type of seat; a 'fliptop' type of seat; a wire mesh type of seat, and a park bench. The types of seat tested are all in use in West Yorkshire, and were set at typical heights that have been found in practice. Details of the seats and their dimensions are to be found in Appendix D.

5.2 Participants were asked whether they had seen each of the seat types before, whether they had used them before, and whether, having tried them out, they would use them. The results are shown in Table 5.1. Few wheelchair users commented on the seats. It can be seen that the disability groups gave similar answers, and for this reason the whole sample can be described together.

5.3 The perch type of seat was the least frequently seen of seats, and the park bench had been seen by almost everyone. The wire top and fliptop had been seen by about half of the sample, the wire top less so than the flip top. the pattern of whether participants had used the seats followed that of whether they had seen them.

5.4 The results showed that the park bench would be used by almost everyone, but that the perch would only be used by about a third of the sample. Although the wire top has been seen or used by less of the sample than the flip top, more people, about two thirds of the sample, said that they would use it than the flip top. It is possible that unfamiliarity with a seat type may have influenced the results.

5.5 To investigate further the characteristics of the seats a number of questions were asked about each seat type. The results are shown in Figure 5.1.1 - 5.1.4. From interpretation of the figures it can be seen that all the disability groups gave similar results, and for this reason the whole sample can be described together as well.

5.6 The Figures show the percentage of each disability group who said that they agreed with statements that were read out to them. Each statement was paired with an opposing statement, e.g.
"This seat would be comfortable for me to sit on" was paired with "This seat would be uncomfortable for me to sit on".

Table 5.1: Participants Saying They Have Seen, Used and Would Use Seat Types

Seat type	Seen seat type before?	Used seat type before	Would use seat type
Wheelchair users Total 10			
Perch	1	1	1
Fliptop	4	2	3
Wire	3	1	4
Park bench	9	8	7

Seat type	Seen seat type before?	Used seat type before	Would use seat type
Stick users Total 48			
Perch	3	0	22
Fliptop	27	17	24
Wire top	13	10	37
Park bench	45	42	44

Seat type	Seen seat type before?	Used seat type before	Would use seat type
Visually handicapped Total 34			
Perch	1	3	12
Fliptop	18	17	20
Wire top	10	9	29
Park bench	29	32	34

Seat type	Seen seat type before?	Used seat type before	Would use seat type
No aids used Total 32			
Perch	1	1	12
Fliptop	24	15	18
Wire top	11	8	22
Park bench	32	31	29

5.7 The percentage agreeing with each statement have been shown next to each other e.g. 5 of the 10 wheelchair users who took part in the exercise (50%) said they could sit comfortably on the park bench and 1 person (10%) said they would be uncomfortable, and this is shown on the top right hand side of figure 5.1.1.

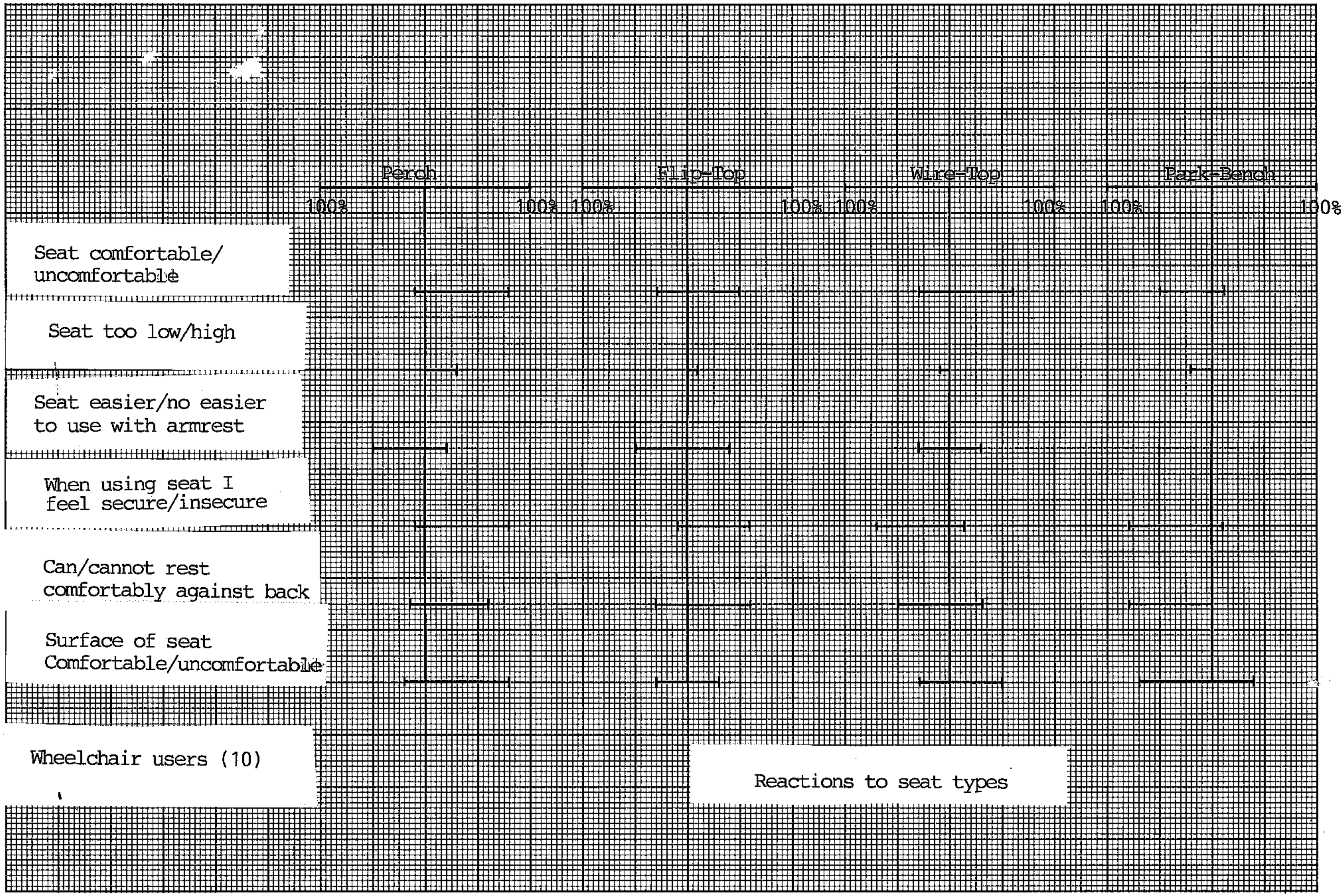

Perch
Flip-Top
Wire-Top
Park-Bench
100%
100%
100%
100%
100%
100%
100%
100%
Seat comfortable/ uncomfortable
Seat too low/high
Seat easier/no easier to use with armrest
When using seat I feel secure/insecure
Can/cannot rest comfortably against back
Surface of seat Comfortable/uncomfortable
Wheelchair users (10)
Reactions to seat types

Fig 5.1.1

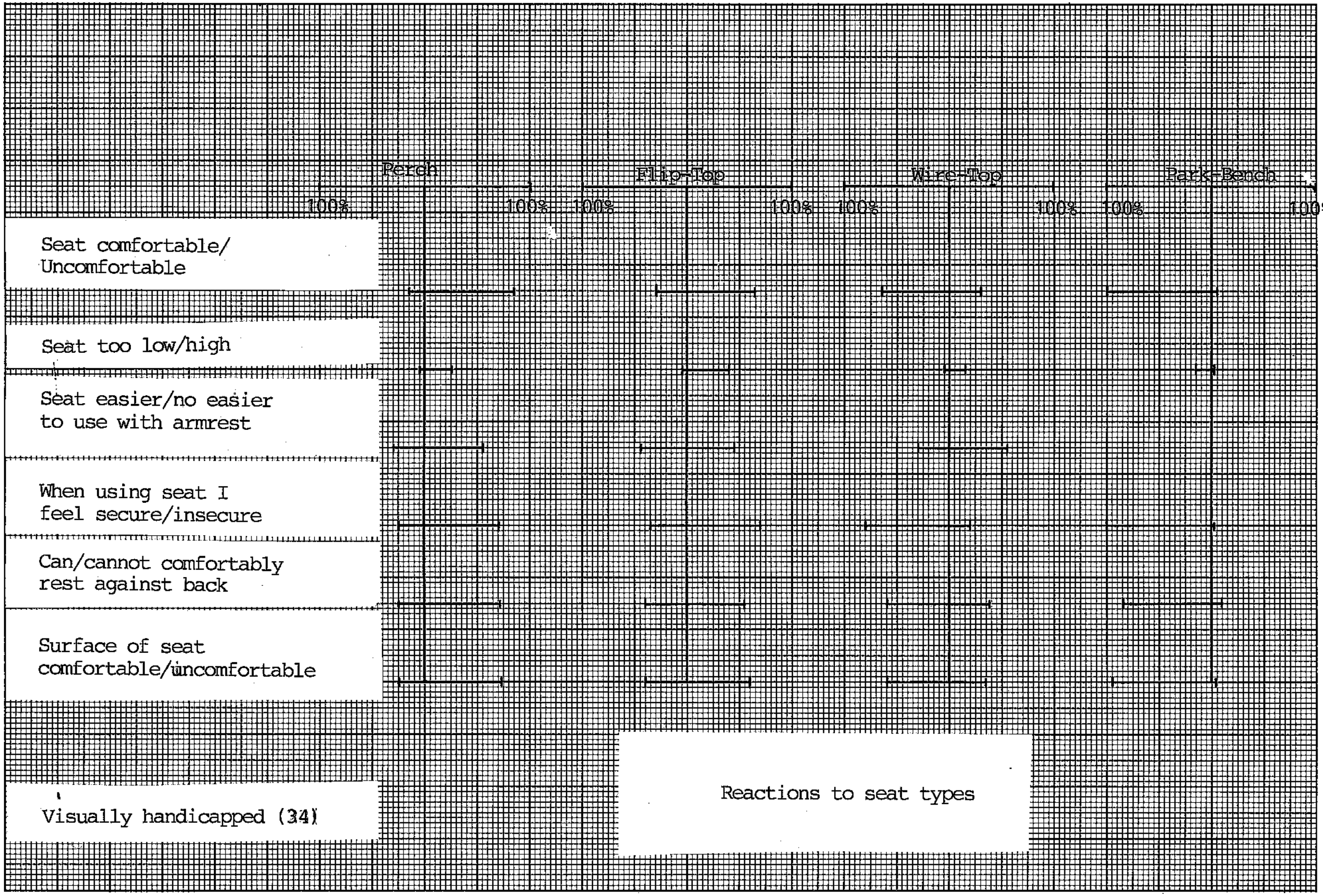

Perch
Flip-Top
Wire-Top
Park-Bench
100% 100% 100% 100% 100% 100% 100% 100%
Seat comfortable/
Uncomfortable
Seat too low/high
Seat easier/no easier
to use with armrest
When using seat I
feel secure/insecure
Can/cannot comfortably
rest against back
Surface of seat
comfortable/uncomfortable
Visually handicapped (34)
Reactions to seat types

Fig 5.1.2

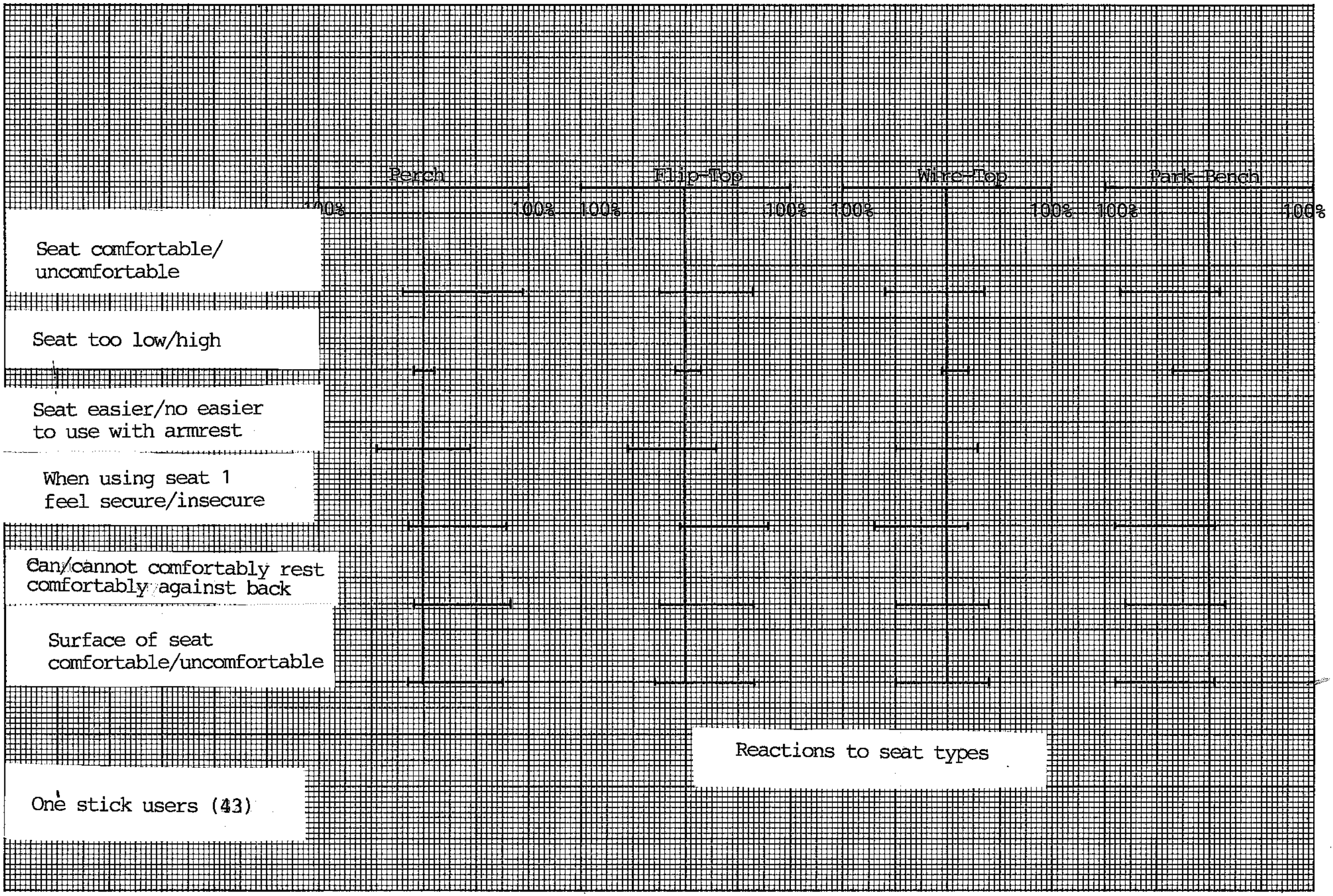

Perch
Flip-Top
Wire-Top
Park Bench
100% 100%
100% 100%
100% 100%
100% 100%
Seat comfortable/uncomfortable
Seat too low/high
Seat easier/no easier to use with armrest
When using seat 1 feel secure/insecure
Can/cannot comfortably rest comfortably against back
Surface of seat comfortable/uncomfortable
Reactions to seat types
One stick users (43)

Fig 5.1.3

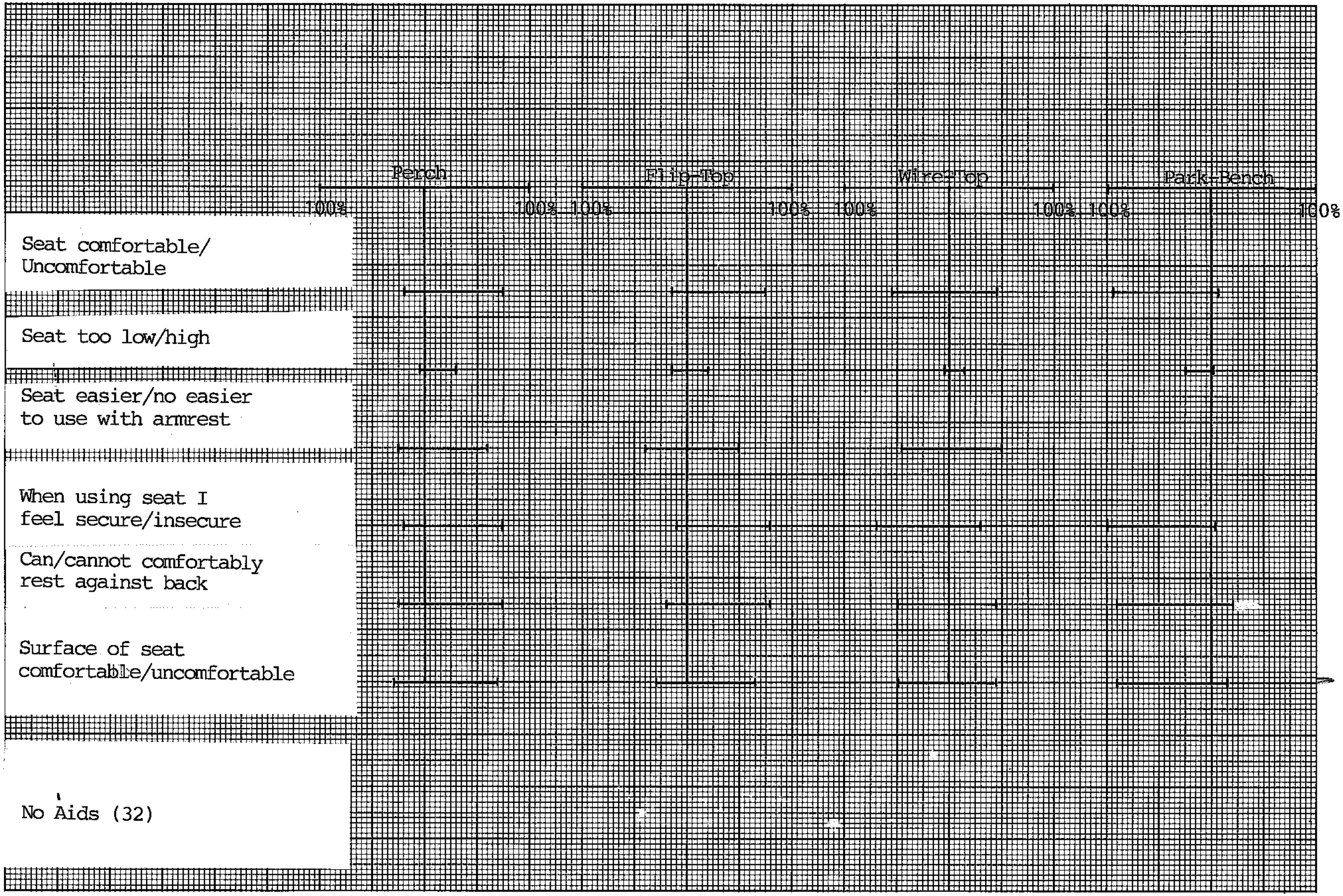

Perch
Flip-Top
Wire-Top
Park-Bench
100% 100% 100% 100% 100% 100% 100% 100%
Seat comfortable/ Uncomfortable
Seat too low/high
Seat easier/no easier to use with armrest
When using seat I feel secure/insecure
Can/cannot comfortably rest against back
Surface of seat comfortable/uncomfortable
No Aids (32)

Fig 5.1.4

5.8 Where a sample of participants agreed with neither statement, i.e. where they felt neutral about a particular point, then this would be shown up by the line being short, and vice versa.

5.9 It would be theoretically possible for a participant to contradict him or herself by agreeing with opposing statements. This did not actually happen, though.

5.10 The results show that, in general the park bench was found comfortable, with the exception of wheelchair users, of whom only one half said it was comfortable. Very few participants said it was uncomfortable. The reverse was true for the perch, very few said it was comfortable, and many said it was uncomfortable.

5.11 Few people agreed with the statements saying that any of the seats were too high or too low to get onto or out of, indicating that in general the heights of the seats were adequate. No-one said the park bench was too high and a few agreed that it was too low, indicating that the seat might be more satisfactory if it was higher.

5.12 Opinions were divided as to whether the seats would be easier to user if they had arm rests. About half thought that they would be easier to use. Statements relating to the park bench have not been shown as this seat already has an arm rest.

5.13 There was a substantial difference between the responses to the perch and fliptop seats, and the wire top and park bench seats in respect of the security which participants felt while using them. A large number of participants agreed with the statement that when they sat on the perch or fliptop seats they felt 'a little insecure'. This was due to the narrowness of the perch seat, and the commonly made comment that the flip top seat felt "wobbly".

5.14 The reverse was true of the wire top and park bench seats, with participants generally agreed that they felt secure while using the seats.

5.15 A substantial number of participants reported that they could not comfortably rest against the back provided to the perch, fliptop and wire top seats.

5.16 The seats were provided with vertical wooden backs and no comments were recorded which might explain this finding. This criticism was not applied to the park bench.

5.17 Questions were asked relating to the seat surface. The smooth metallic surface of the perch type seat was found to be generally uncomfortable, and some participants commented that it was too cold.

5.18 There is no clear picture relating to the surfaces of the flip top or wire top seats - some participants saying that the surfaces were comfortable, and others saying that the surfaces were uncomfortable. The wooden slatted surface of the park bench was clearly found to be comfortable by most participants.

5.19 The most commonly made comment on the flip top was that the top was unsteady or 'wobbly', that it was too narrow and easy to fall or slip off.

5.20 Comments received on the wire top surface covered many different aspects, but that it was too narrow was the most frequently made comment, followed by the advantage that rain does not gather on the surface.

5.21 After participants had assessed all the seats they were asked which seat they like best and which they liked least. It was clear that the most favoured seat was the park bench, and the least favoured, the perch seat.

6. References

Road Research Laboratory Ministry of Transport (1969) Road Note 27 Instructions for Using the Portable Skid-Resistance Tester HMSO.

Berrett B, Leake G, May A D, Whelan J (1988) Ergonomic Standards for Pedestrian Areas for Disabled People: Literature Review and Consultations. WP 252 Institute for Transport Studies, University of Leeds.

Berrett B, Leake G, May A D, Whelan J (1988) Ergonomic Standards for Pedestrian Areas for Disabled People: Methodology and Sample Identification. WP 253 Institute for Transport Studies, University of Leeds.

Berrett B, Leake G, May A D, Parry T, Whelan J (1988) Ergonomic Standards for Pedestrian Areas for Disabled People: Results of the Initial and Main Interviews. WP 254 Institute for Transport Studies, University of Leeds.

Berrett B, Leake G, May A D, Parry T, Whelan J (1988) Ergonomic Standards for Pedestrian Areas for Disabled People: Results from Observation Work. WP 255 Institute for Transport Studies, University of Leeds.

Berrett B, Leake G, May A D, Parry T (1989) Ergonomic Standards for Pedestrian Areas for Disabled People: Results from Interviews Conducted in Beverley and York. WP 274 Institute for Transport Studies, University of Leeds.

TP/erb
Nov89

Appendix A

Effects of Refreshment on Movement Distance Time

	Before Coffee No.	Before Coffee Mean (mins)	Before Coffee Std.Dev. (mins)	After Coffee No.	After Coffee Mean (mins)	After Coffee Std.Dev. (mins)
Wheelchair users	39	3.77	2.02	17	3.47	0.97
Stick users	30	6.09	5.21	21	5.39	1.75
All visually handicapped	27	4.00	1.46	13	3.63	1.13
No aids	22	3.42	0.80	18	4.04	1.29

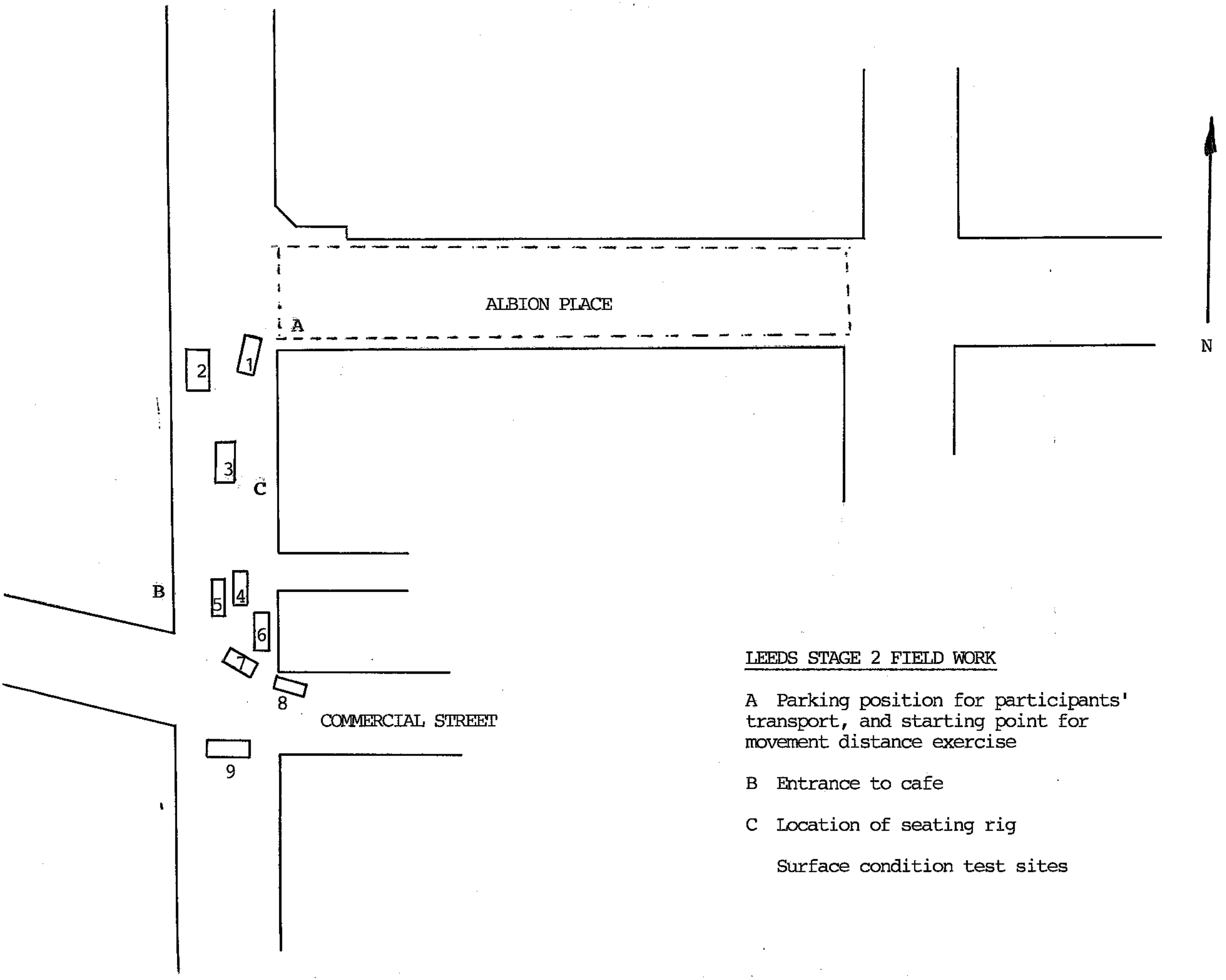
APPENDIX B

Effect of Refreshment on Number of Pauses Taken

	Before Refreshment	After Refreshment
Total number* known	123	85
Number of people pausing at least once	21	16
Probability of taking a pause	0.17	0.19

* for the balance of participants it was not known whether the exercise was conducted before or after refreshments.

APPENDIX C



LEEDS STAGE 2 FIELD WORK

A Parking position for participants' transport, and starting point for movement distance exercise

B Entrance to cafe

C Location of seating rig

Surface condition test sites

(4/10/88)

APPENDIX E

Observation - Leeds City Centre 1988 Esdipa

Interviewee's identity number . . . . ______ [ ][ ][ ]

Interviewee's Name and Address (including postcode)

[ ][ ][ ]
[ ][ ][ ]

Interviewee's Telephone number . . . . . ______________

Interviewee's sex M . . . (1) F. . . . (2) [ ]

Interviewee's date of birth . . . . ______ [ ][ ]

Interviewers name . . . . ________ [ ][ ][ ]

Today's Date . . AM/PM BEFORE/AFTER COFFEE [ ][ ][ ]

WEATHER . . . . DRY/WET [ ]

(Please ring ONE statement only, relating to aids in use.)

Wheelchair, manual . . . .(01)
Wheelchair, powered. . . . .(02)
One walking stick . . . .(03)
Two walking sticks, or elbow crutches. . . . . . .(04)
Arm crutches, or walking frame . . . .(05) [ ][ ]
White stick . . . .(06)
White cane . . . .(07)
Guide dog . . . .(08)
None (Please state what disability) . . . .(09)
Other (Please state) . . . .(10)

(If "none" please try to find out what the respondents disability is, eg angina. If a combination of these aids is normally used, please circle "other" and note what the aids normally used are).

(Where "wheelchair" is specified, in following questions use "move your wheelchair" etc instead of "walk".

Q 2 If the weather is not too bad, how often do you normally go outside your house for any reason, such as shopping, visiting friends, or going to the doctor? Please choose the one of these that fits best:

Every day . . . .(1)
Most days . . . .(2)
About once per week . . . .(3) [ ]
About once per month. . . . .(4)
Much less often . . . .(5)

Q 3 Which one of these statements is most true about you when you go outside your home, for example, to go shopping, visiting friends, or going to the doctor.

When I go outside my house I must always have someone to assist me (Go To Q5) . . . . (1)

When I go outside my house I find that having someone to assist me is very useful, although I can usually manage on my own . . . . (2) [ ]

When I go outside my house I do not need any assistance . . . . (3)

(Please ring ONE statement only)

Q 4 With the aids that you normally use when you go outside unassisted, how far can you normally walk, /move your wheelchair/, on level ground, between pauses for rest?

0 - 20 yards . . . . (1)
21 - 75 yards. . . . . (2) [ ]
76 - 150 yards . . . . (3)
more than 150 yards. . . . . (4)
never goes out unassisted . . . . (5)

(Please ring ONE statement only. If the interviewee is having difficulty estimating how far these distances are, then indicate some typical distances)

Q 5 If you are accompanied, by someone who may assist you, how far can you normally walk, /move your wheelchair/ on level ground, between pauses for rest?

0 - 20 yards . . . . (1)
21 - 75 yards. . . . . (2) [ ]
76 - 150 yards . . . . (3)
more than 150 yards. . . . . (4)

(Instructions as for Q 4.)

Q 6 If the weather is not too bad, how often do you normally go to the city centre for any reason, such as shopping, visiting friends, or going to work? Please choose the one of these that fits best:

Every day . . . . (1)
Most days . . . . (2)
About once per week . . . . (3) [ ]
About once per month. . . . . (4)
Much less often . . . . (5)

(Please ring ONE statement only)

Movement Distance traverse

What we would like you to do is to walk around a short route and when you come back I'll ask you a few questions.

(Explain the route)

Take your time as you go round, and any time you want to sit down to rest or just pause then do so. It isn't a race, and we are not trying to see how fast you can go, so please just go round at your own pace.

If you want to stop at any time and not go any further, then please indicate this to me.

(Explain that you want to fit the participant with a tape recorder so that any comments they want to make about fatigue, or the state of the pavements, or anything else connected with the route they are travelling on can be recorded.)

(Fit the recorder. Test that it is working. Record the participant's name and the date onto the tape. Take the participant to the starting position.)

This is where I would like you to start from. Please remember to go at your own speed, and to rest as often, and for as long as you wish. Don't forget that you have a tape recorder on, so that any comments you have as you go round can be recorded.

(Ask participant to start. Note times of passing corners, pauses etc.)

Event

Pass corner/midpoint 1 Sit . .2 Pause while standing . . 3
Start moving . . . . 4 NON-REST PAUSE 5
OTHER 6

Location	Event	Time hr	min	sec	
Albion Street South	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Midpoint South Albion Place	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Lands Lane South	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Lands Lane North	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Midpoint North Albion Place	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Albion Street North	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]

(On completion of first circuit, ask Q 7)

Q 7 How does the distance you have moved so far today compare with how far you normally move when you/come into the city centre. (IF CITY CENTRE NOT USED: /NORMALLY GO OUT)

Is it further than you normally move, ...(1)
About the same distance as you normally move, or .(2)
Not as far as you normally move. . . . .(3) [ ]

(IF MANUAL WHEELCHAIR)

NORMALLY SELF-PROPELLED . . (1)
NORMALLY PROPELLED BY PERSON PUSHING TODAY . (2) [ ]
NORMALLY PROPELLED BY SOME OTHER PERSON . . (3)

Invite participants to travel around the route for a second time, after resting if they wish, but do not be insistent. Point out that it will be quite alright if they do not wish to go round again.

<u>Event</u>
Pass corner/midpoint 1   Sit . .2   Pause while standing . . 3
Start moving 4   Other (please state) . 5

Location	Event	Time hr	min	sec	
Albion Street South	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Midpoint South Albion Place	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
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					[ ] [ ][ ] [ ][ ] [ ][ ]
Lands Lane South	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
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Lands Lane North	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
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Midpoint North Albion Place	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
Albion Street North	1				[ ] [ ][ ] [ ][ ] [ ][ ]
					[ ] [ ][ ] [ ][ ] [ ][ ]
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					[ ] [ ][ ] [ ][ ] [ ][ ]

Q 8 How does the distance you have moved so far today compare with how far you normally move when you come into the city centre.

Is it further than you normally move, ...(1)
About the same distance as you normally move, or .(2)
Not as far as you normally move. . . . .(3)   [ ]

Q 9 Go to each surface condition location in turn. At each location point out to participants the area, ask the questions and then move to next location

In general, how difficult do you find moving over the marked area? Choose from:

Impossible. 1
Very difficult. 2
Difficult 3
Some difficulty 4
No difficulty 5

In general how much of a risk of stumbling /disrupting your progress/ do you think that the marked area could represent to you? Choose from:

A severe risk. 1
A slight risk. 2
No significant risk. 3

If "No difficulty" and "No significant risk" not selected:

What is it about the marked area that causes you difficulty? Do you think it is gaps in between pavers, the slope of the pavement, camber, general unevenness, slipperiness, or something else?

Put a 1 for each variable that is mentioned. Note what "something else" is in the "other" column

Is there one thing about this site that makes it particularly bad? If so, what is it?

Overwrite an asterisk in the appropriate box, if respondent does point out one particularly bad variable

Loc	SEVERITY	RISK	GAPS	SLOPE	CAMBER	UNEVEN	SLIP.	OTHER	
1									[ ][ ][ ][ ][ ][ ][ ]
2									[ ][ ][ ][ ][ ][ ][ ]
3									[ ][ ][ ][ ][ ][ ][ ]
4									[ ][ ][ ][ ][ ][ ][ ]
5									[ ][ ][ ][ ][ ][ ][ ]
6									[ ][ ][ ][ ][ ][ ][ ]
7									[ ][ ][ ][ ][ ][ ][ ]
8									[ ][ ][ ][ ][ ][ ][ ]
9									[ ][ ][ ][ ][ ][ ][ ]
10									[ ][ ][ ][ ][ ][ ][ ]

Q 10 Take participant to each seating unit, and make it clear that we are interested in the actual seat, not the framework.

We would like you to try out these seats, that may be familiar to you as the type found at bus shelters in the Leeds area.

For each type of seat in turn:

Note which seat the respondent is being shown, and any details of seat position ____________________ [ ][ ][ ]

Have you seen this type of seat before, possibly at a bus shelter or station?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

Have you used this type of seat before?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

If you were waiting for a bus which was not expected for the next five minutes or so, would you use this type of seat if it were available?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

Here are some statements that might be true or false about what you think of this type of seat. Please say if you think they are true about how you feel about the seat:

Ring all statements with which participant agrees

a This seat would be comfortable for me to sit on . . 1 [ ]
b This seat would be uncomfortable for me to sit on . 1 [ ]
c This seat is too low for me to easily get into or out of . . . . 1 [ ]
d This seat is too high for me to easily get into or out of. 1 [ ]
e I would find it easier to use this seat if it had an armrest . . . . .1 [ ]
f I would find it no easier to use this seat if it had an armrest . . . . .1 [ ]
g When I sit in this seat I feel quite secure. . . . .1 [ ]
h When I sit in this seat I feel a little insecure . .1 [ ]
i When I sit in this seat I can comfortably rest against the back . . . . .1 [ ]
j When I sit in this seat I cannot comfortably rest against the back . . . . 1 [ ]
k I find the surface of this seat comfortable . . . . 1 [ ]
l I find the surface of this seat uncomfortable . . . 1 [ ]
m What other features are there about this seat that you think are good or bad? (Please note) - [ ][ ]

Move to next seat.

Note which seat the respondent is being shown, and any details of seat position ______________________ [ ][ ][ ]

Have you seen this type of seat before, possibly at a bus shelter or station?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

Have you used this type of seat before?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

If you were waiting for a bus which was not expected for the next five minutes or so, would you use this type of seat if it were available?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

Here are some statements that might be true or false about what you think of this type of seat. Please say if you think they are true about how you feel about the seat:

Ring all statements with which participant agrees

a	This seat would be comfortable for me to sit on . .	1	[ ]
b	This seat would be uncomfortable for me to sit on .	1	[ ]
c	This seat is too low for me to easily get into or out of	1	[ ]
d	This seat is too high for me to easily get into or out of.	1	[ ]
e	I would find it easier to use this seat if it had an armrest	1	[ ]
f	I would find it no easier to use this seat if it had an armrest	1	[ ]
g	When I sit in this seat I feel quite secure.	1	[ ]
h	When I sit in this seat I feel a little insecure . .	1	[ ]
i	When I sit in this seat I can comfortably rest against the back	1	[ ]
j	When I sit in this seat I cannot comfortably rest against the back	1	[ ]
k	I find the surface of this seat comfortable	1	[ ]
l	I find the surface of this seat uncomfortable . . .	1	[ ]
m	What other features are there about this seat that you think are good or bad? (Please note)		[ ][ ]

Move to next seat.

Note which seat the respondent is being shown, and any details of seat position ____________________ [ ][ ][ ]

Have you seen this type of seat before, possibly at a bus shelter or station?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

Have you used this type of seat before?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

If you were waiting for a bus which was not expected for the next five minutes or so, would you use this type of seat if it were available?

Yes 1
No 2
Don't know/unsure . . . 3 [ ]

Here are some statements that might be true or false about what you think of this type of seat. Please say if you think they are true about how you feel about the seat:

Ring all statements with which participant agrees

a	This seat would be comfortable for me to sit on . .	1	[ ]
b	This seat would be uncomfortable for me to sit on .	1	[ ]
c	This seat is too low for me to easily get into or out of	1	[ ]
d	This seat is too high for me to easily get into or out of.	1	[ ]
e	I would find it easier to use this seat if it had an armrest	1	[ ]
f	I would find it no easier to use this seat if it had an armrest	1	[ ]
g	When I sit in this seat I feel quite secure.	1	[ ]
h	When I sit in this seat I feel a little insecure . .	1	[ ]
i	When I sit in this seat I can comfortably rest against the back	1	[ ]
j	When I sit in this seat I cannot comfortably rest against the back	1	[ ]
k	I find the surface of this seat comfortable	1	[ ]
l	I find the surface of this seat uncomfortable . . .	1	[ ]
m	What other features are there about this seat that you think are good or bad? (Please note)		[ ][ ]

Move to next seat.

Note which seat the respondent is being shown, and any details of seat position ______________________ [ ][ ][ ]

Have you seen this type of seat before, possibly at a bus shelter or station?

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Don't know/unsure . . . 3 [ ]

Here are some statements that might be true or false about what you think of this type of seat. Please say if you think they are true about how you feel about the seat:

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a This seat would be comfortable for me to sit on . . 1 [ ]
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k I find the surface of this seat comfortable . . . . 1 [ ]
l I find the surface of this seat uncomfortable . . . 1 [ ]
m What other features are there about this seat that you think are good or bad? (Please note) [ ][ ]

Q 11 Which of the seats that you have been shown do you like best? ______________________ [ ]

Q 12 Which of the seats that you have been shown do you like least? ______________________ [ ]